Pleurosira (Meneghini) Trevisan 1848

Type species: *Pleurosira thermalis* Meneghini

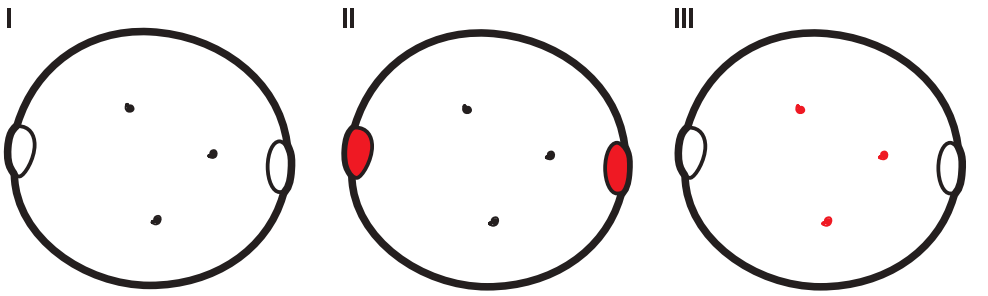
SYNONYM:
Melosira C. Agardh 1824 pro parte
Biddulphia Gray 1821 pro parte

Characteristics – Cells **centric**, oval (**orbicular**) in shape. Valve bears a number of **ocelli** (usually 2) on the valve margin (II). Areolae round, discernable under LM. Short spines and silica granules scattered over the valve face and the valve mantle (III) but may be difficult to observe using LM (Fig. 32: E). A number (1-5) of **rimoportulae** are scattered across the valve face (III; Fig. 32: A-D, E).

Plastid structure – Many small discoid plastids.

Identification of species – Up till now only one species known from tropical Africa: *Pleurosira laevis* (Ehrenberg) Compère.

Ecology – Cells exude mucilage from **ocelli** forming zig-zag chains. Typical of tropical waters with high conductivity and anthropogenically impacted habitats.



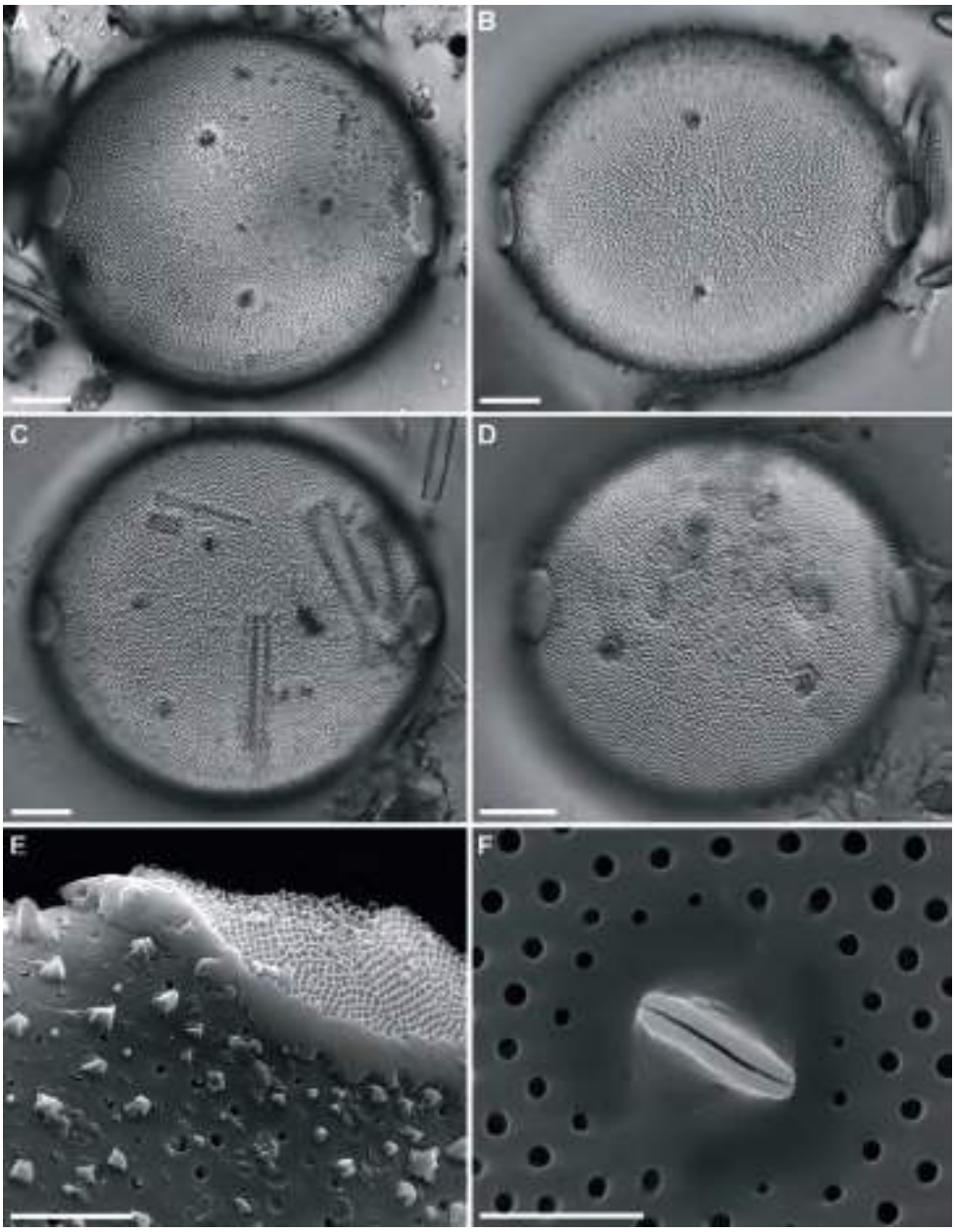


Fig. 32. *Pleurosira* laevis. **A-D.** LM, valve views, note the ocelli. **E-F.** SEM. **E.** External view of valve, detail of an ocellus. **F.** Internal view of valve, detail of a rimoportula.
Scale bars = 10 µm (A-D), 2 µm (E-F).

Urosolenia Round & R.M. Crawford 1990

Type species: *Urosolenia eriensis* (H.L. Smith) Round & R.M. Crawford

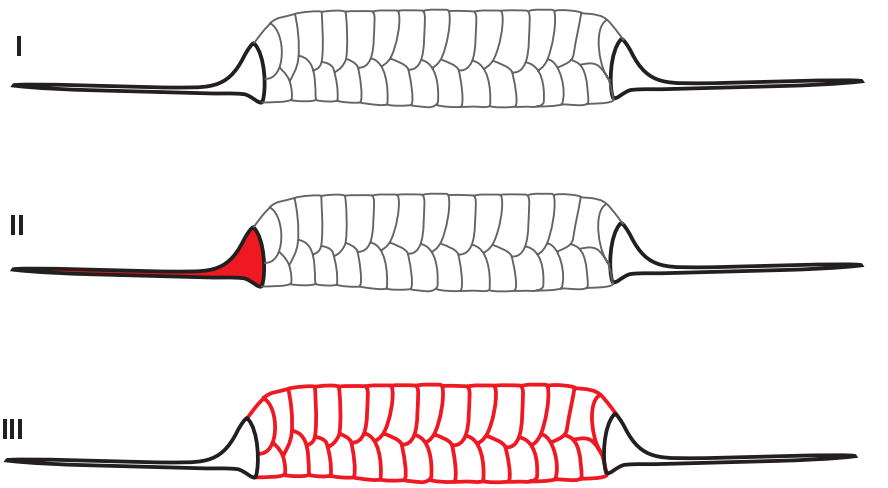
SYNONYM:
Rhizosolenia Brightwell 1858 pro parte

Characteristics – A **centric** diatom genus. Cells **cylindrical** with a small valve and elongate spine (II) on each valve. Frustule very lightly silicified, and the spines may be the only structure remaining after treatment and cleaning of the sample. The valves are joined by scale-like girdle bands (III, Fig. 33: E) (**copulae**), these copulae are rarely discernable under LM.

Plastid structure – Cells with numerous discoid plastids.

Identification of species – Species can be identified by cell size, cell shape and width and the structure of the valve.
Note: Many important cell characteristics can only be observed using SEM.

Ecology –- Cells solitary, planktonic. Found in oligotrophic waters with low to moderate conductivities.



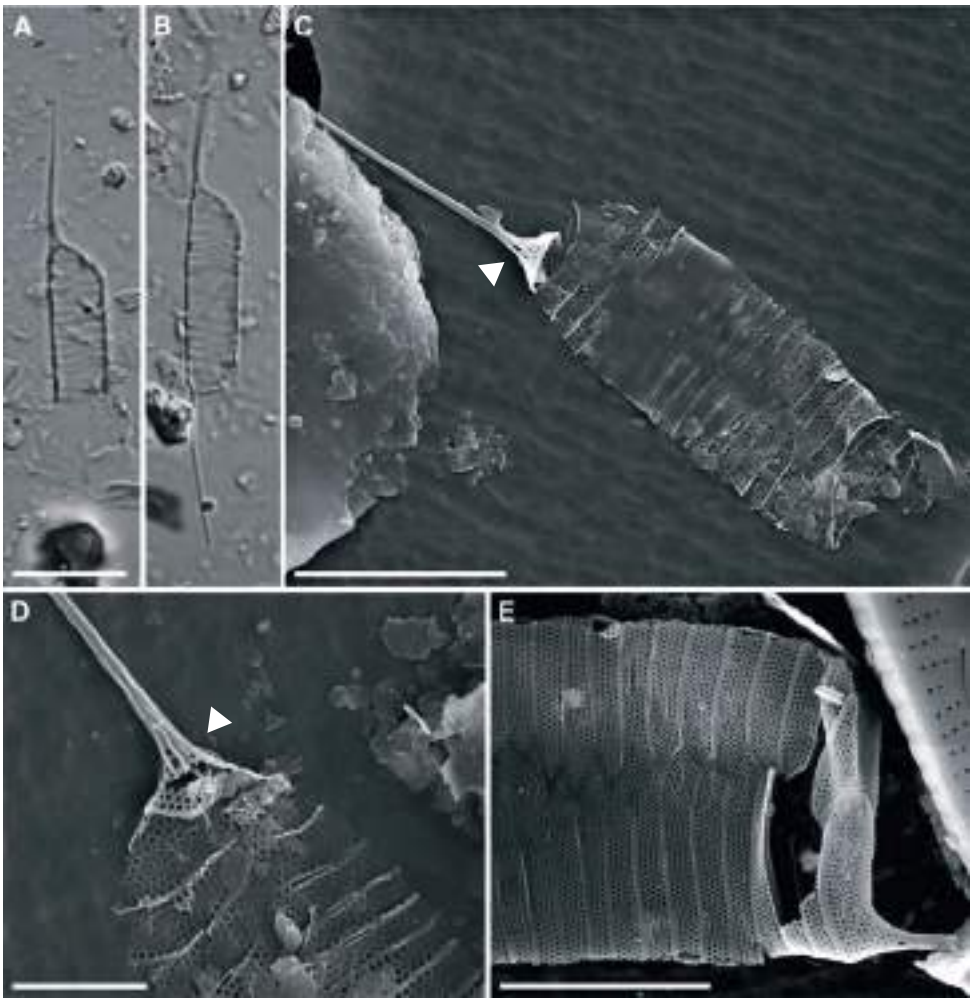


Fig. 33. *Urosolenia* spp. **A-B.** LM, girdle view. **C-E.** SEM. **C-D.** Girdle bands and valve with elongated spine (arrows). **E.** Detail of the scale like girdle bands. Scale bars = 10 µm (A-B), 5 µm (C,E), 2 µm (D).

Asterionella Hassall 1850

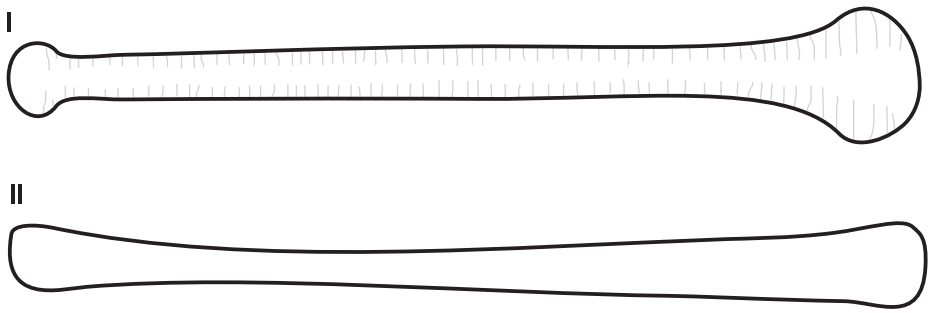
Type species: *Asterionella formosa* Hassall

Characteristics – Cells **araphid**, typically 'bone-shaped' (**heteropolar**) in valve view (I; Fig. 35: A-D) with a larger and smaller pole. Often observed in girdle view (II; Fig. 35: E-G) where one pole is also expanded. Striae are difficult to observe under LM. Spines are present at the junction of the valve face and valve mantle (Fig. 35: F, I). Rimoportulae only visible in SEM (Fig. 35: H).

Plastid structure – Many small plate-like plastids (Fig. 34: A-B).

Identification of species – Up till now only one species occurs commonly in the freshwaters of the tropics: *Asterionella formosa.*

Ecology – Cells colonial, planktonic, suspended in the water column of meso-to eutrophic lakes and impoundments and large rivers. Cells of *Asterionella formosa* secrete mucilage from the pore field of the larger pole and join to form star-like or stellate colonies (Fig. 34: A, C). The increased surface area of these colonies helps to prevent sinking through the water column.



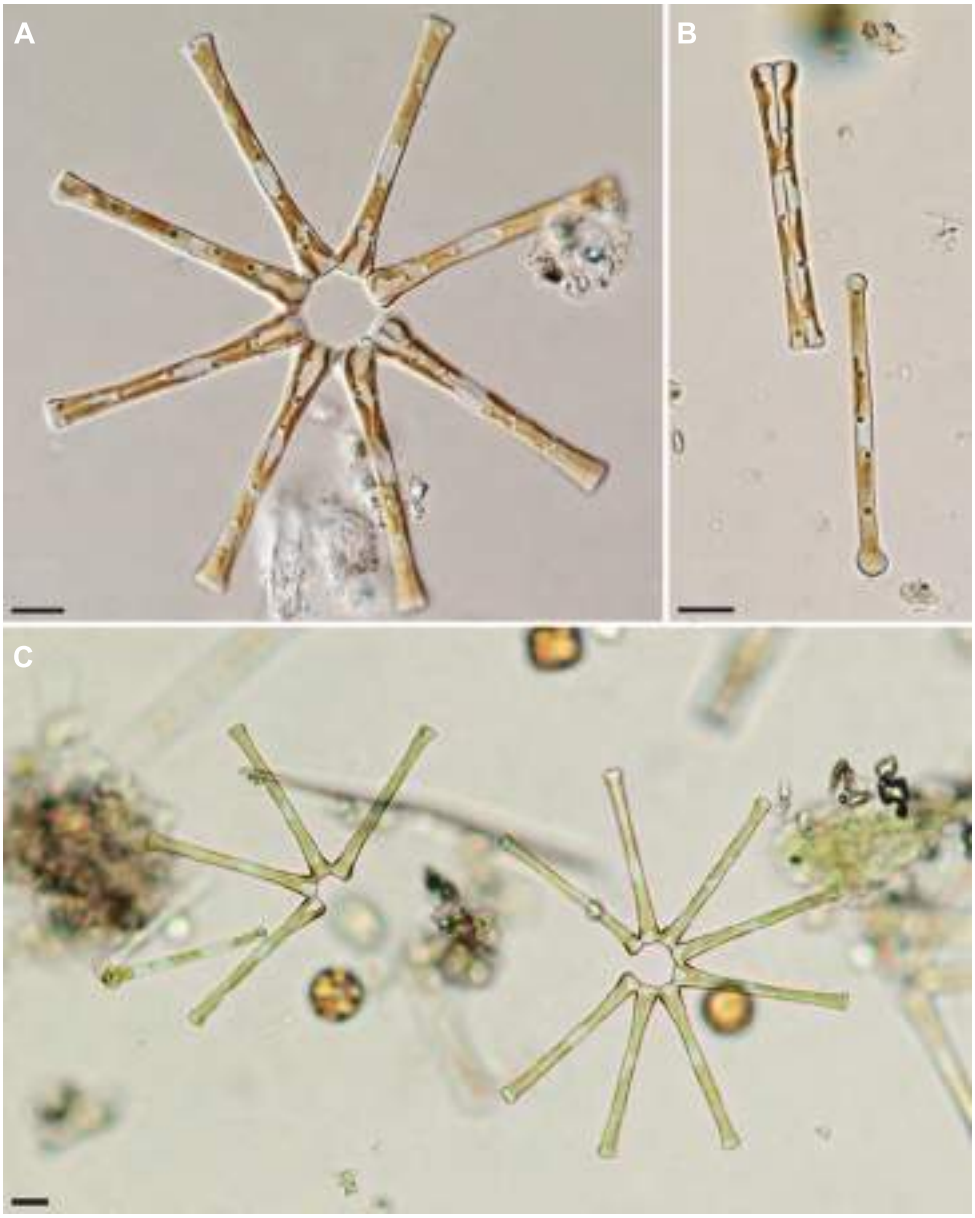


Fig. 34. *Asterionella formosa*. **A-C**. LM. **A**. Living cells, forming typical stellate colony. **B**. Living cells, girdle view, immediately post cell division (left), valve view, note typical 'bone-shape' (right). **C**. Partially formed stellate colonies. Scale bars = 10 µm (A-C).

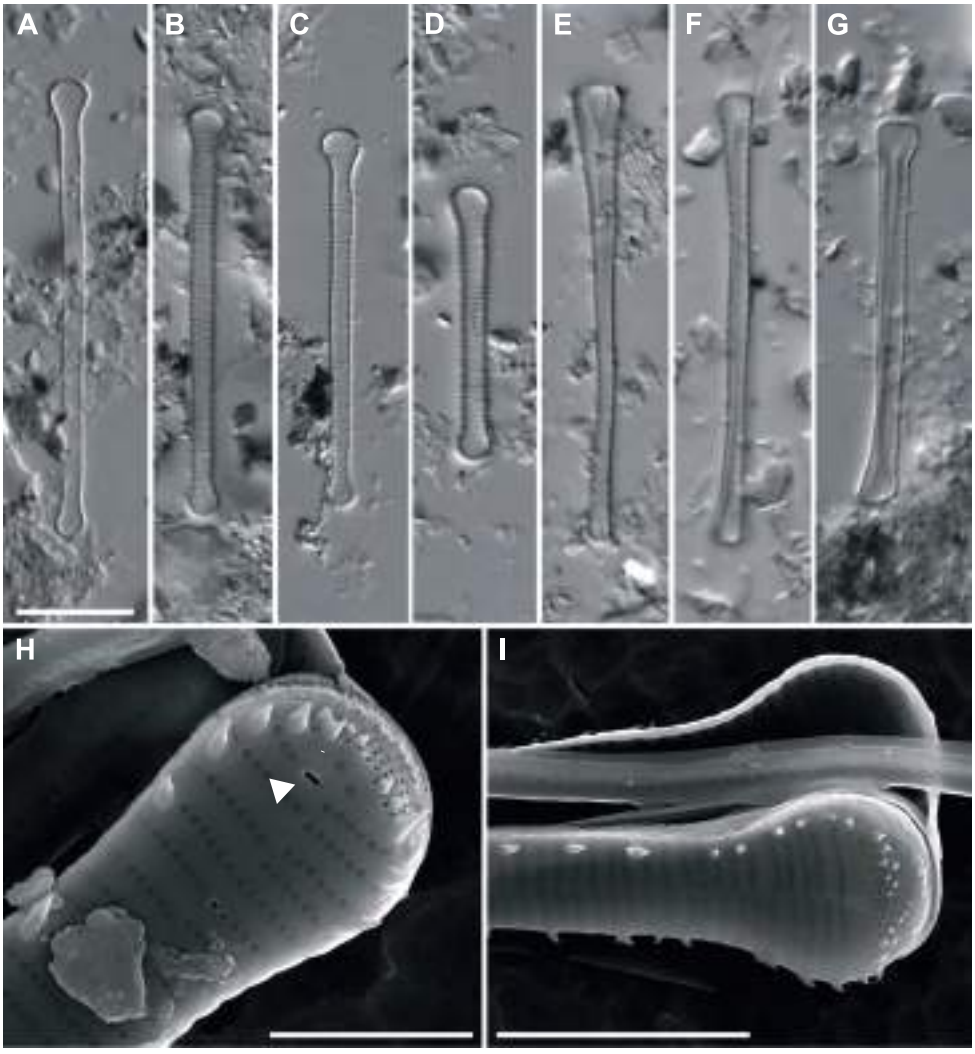


Fig. 35. *Asterionella formosa*. **A-G**. LM. **A-D**. Valve view, note very fient striae and barely visible marginal spines. **H-I**. SEM, cell apices, note apical pore fields, marginal spines and external opening of the rimoportula (arrow).
Scale bars = 10 µm (A-G), 2 µm (H), 5 µm (I).

Ctenophora Grunow ex D.M. Williams & Round 1986

Type species: *Ctenophora pulchella* (Ralfs ex Kützing) D.M. Williams & Round

SYNONYM:

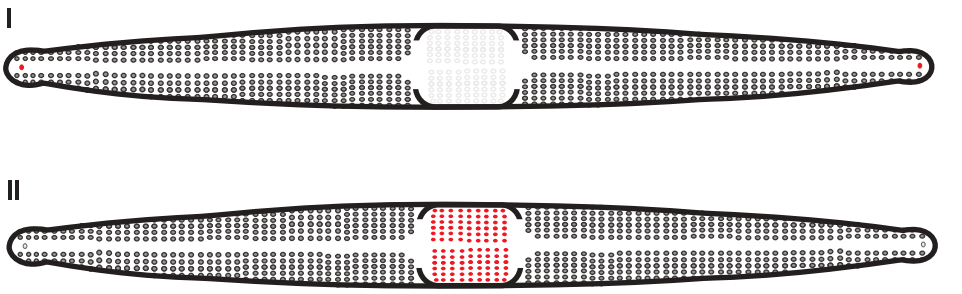
Synedra Ehrenberg 1830 pro parte

Characteristics – Cells **araphid** with parallel striae through the length of the valve, areolae regularly arranged, large and easily observed under LM (Fig. 36: C,D). Areolae with complex structure (Fig. 36: E, F). **Axial area** broad. Central area large (a thickened **fascia**) with **ghost striae** (II, Fig. 36: F, H). **Rimoportula** (labiate or lipped process) present at both apices (I, Fig. 36: E, G).

Plastid structure – Cells with plate-like plastids one lying under each valve face (Fig. 36: A, B).

Identification of species – Up till now only one species known from tropical Africa: *Ctenophora pulchella.*

Ecology – Cells solitary and attached. Found in the benthos of waters with moderate to high conductivity.



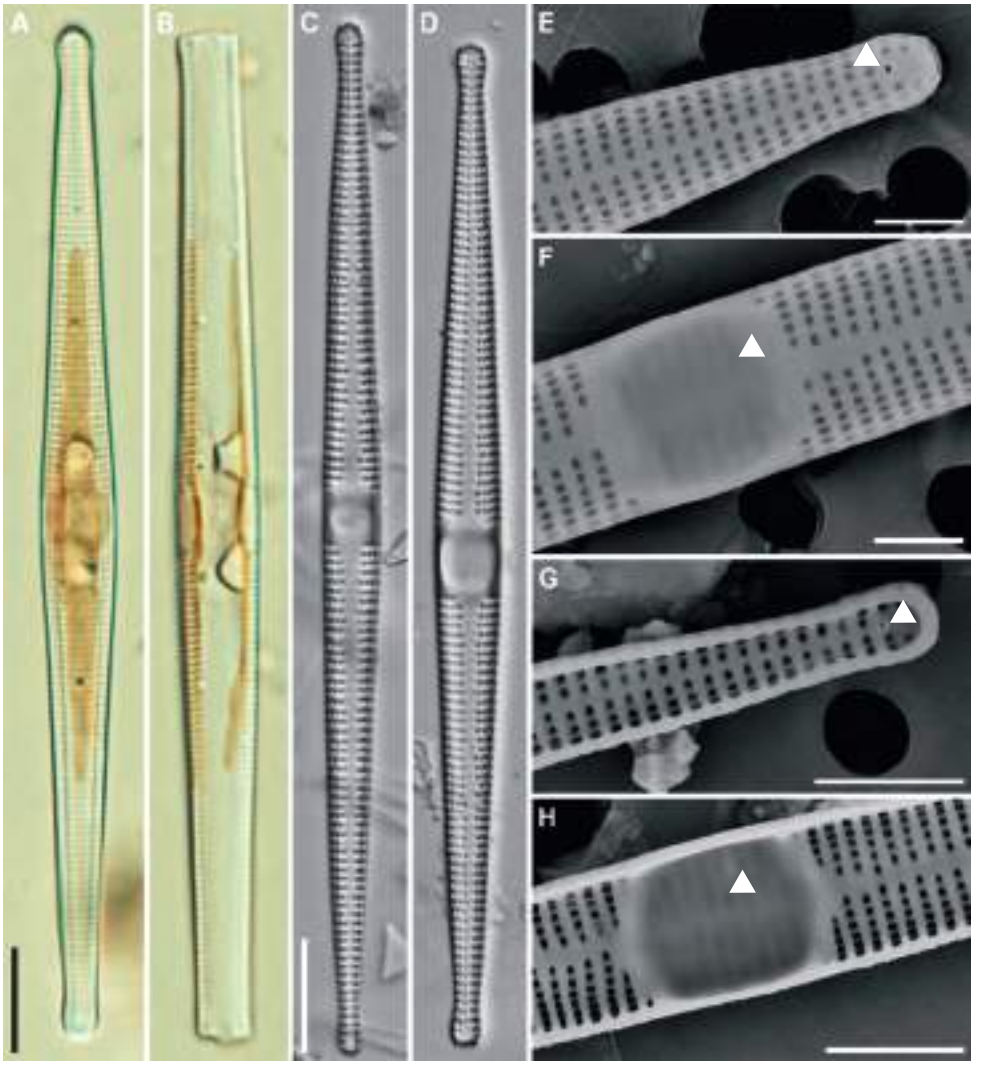


Fig. 36. *Ctenophora pulchella*. **A-D**. LM. **A**. Living cell, valve view. **B**. Living cell, girdle view. **C-D**. Cleaned material, valve view. **E-H**. SEM. **E**. External view of valve, cell apex, note external opening of rimoportula (arrow). **F**. External view of valve, central area, note ghost striae (arrow). **G**. Internal view of valve, cell apex, note internal opening of rimoportula (arrow). **H**. Internal view of valve, central area, note ghost striae (arrow).
Scale bars = 10 µm (A-D), 3 µm (E-F), 5 µm (G-H).

Diatoma Bory 1824

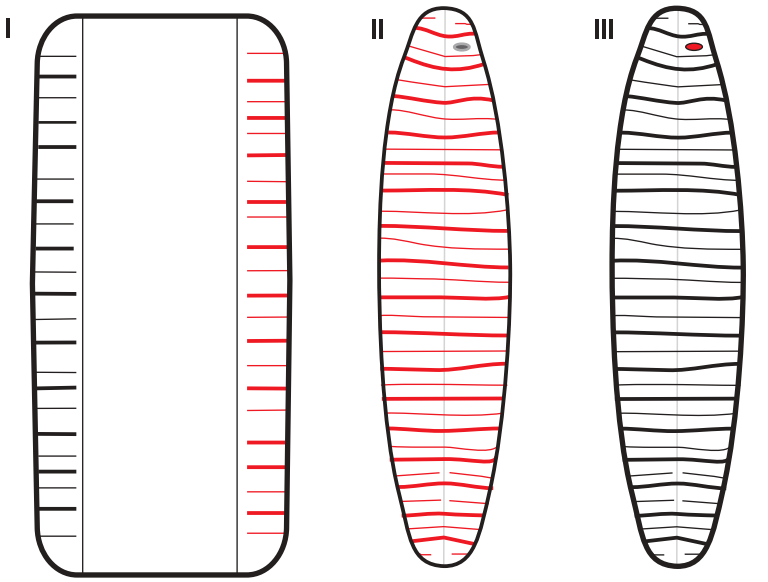
Type species: *Diatoma vulgaris* Bory

Characteristics – Cells **isopolar**, **araphid** with a narrow axial area. Striae composed of very small areolae, difficult to discern in LM. The valve has robust costae which stretch from margin to margin (II, Fig. 37: C, D, F). Costae also visible in girdle view (I, Fig. 37: B). A single rimoportula, sometimes visible in LM, is present near one of the apices (III). **Apical pore fields** at each apex.

Plastid structure – Cells with many small granular plastids (Fig. 37: B).

Identification of species – Up till now only one species known from tropical Africa: *Diatoma vulgaris.*

Ecology – Cells single or in pairs, attached by the corners and non-motile forming colonies. Colonies zig-zag shaped (Fig. 37: B) as cells join corner to corner by a **mucilage pad** exuded from the **apical pore field**. Occur *en-masse* in eutrophic waters forming dense colonies visible to the human eye.



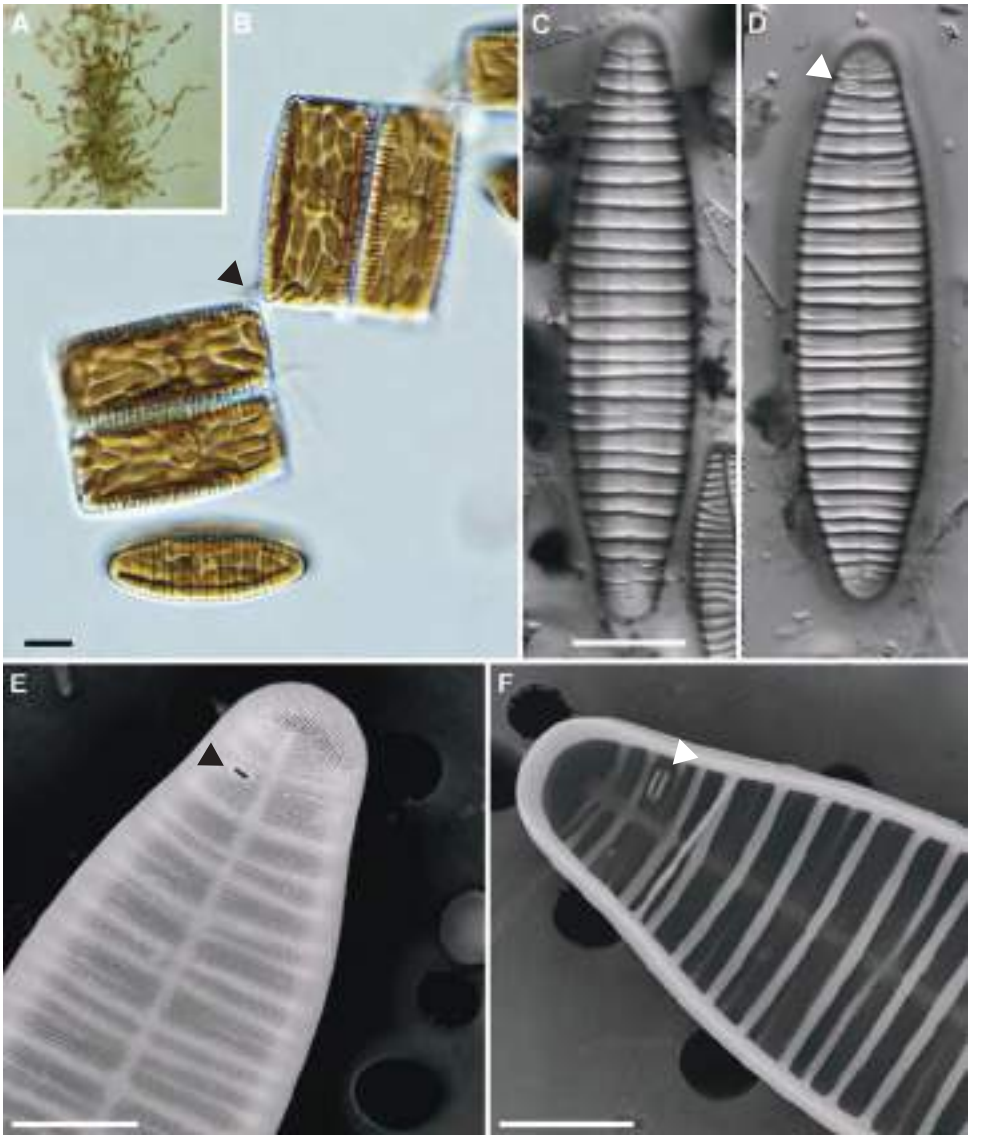


Fig. 37. *Diatoma vulgaris*. **A-D**. LM. **A**. Living cells, colonizing a filament of green algae. **B**. Living cells, girdle and valve views (bottom), note mucilage pads joining cells at the corners (arrow). **C-D**. Valve views of cleaned material, note position of rimoportula (arrow - **D**). **E-F**. SEM. **E**. External view of valve showing external opening of rimoportula (arrow) and apical pore field.
F. Internal view of valve showing the transapical costae and the internal opening of the rimoportula (arrow).
Scale bars = 10 µm (A-D), 5 µm (E-F).

Fragilaria Lyngbye 1819

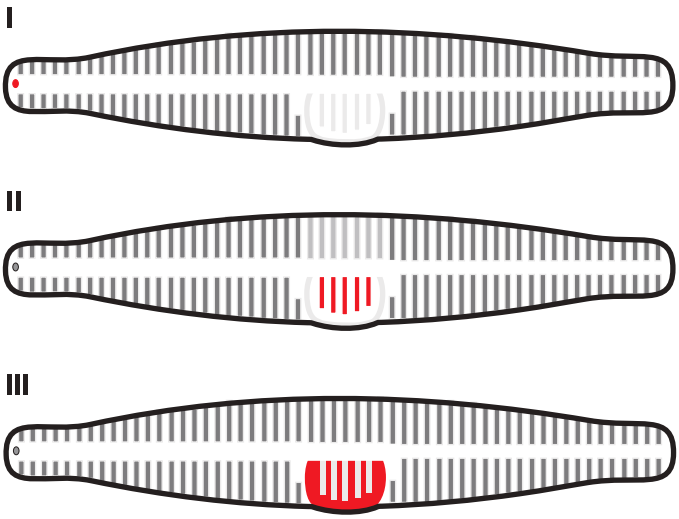
Type species: *Fragilaria pectinalis* (O.F. Müller) Lyngbye

Characteristics – Cells **araphid** with parallel striae through the length of the valve, areolae fine, not easily observed under LM (Fig. 39: A-I). **Axial area** narrow (Fig. 39: E-H) to broad (Fig. 39: D, I). Central area large (a thickened **fascia**; I) with **ghost striae** present (II, Fig. 39: E, F), reaches both valve margins (II, Fig. 39: E, F) or unilaterally expanded (III, Fig. 39: H). **Rimoportula** (labiate or lipped process) (I, Fig. 40: B) present at one apex. Spines at the junction of the valve face and valve mantle.

Plastid structure – Cells with plate-like plastids one lying under each valve face (Fig. 38: A-F).

Identification of species – Species can be identified by cell size, cell shape, structure and density of the striae as well as structure and extent of the axial and central area.

Ecology – Cells colonial, valve face to valve face forming ribbons or basally attached. Found in the benthos of waters with low to moderate conductivity and at a range of trophic levels.



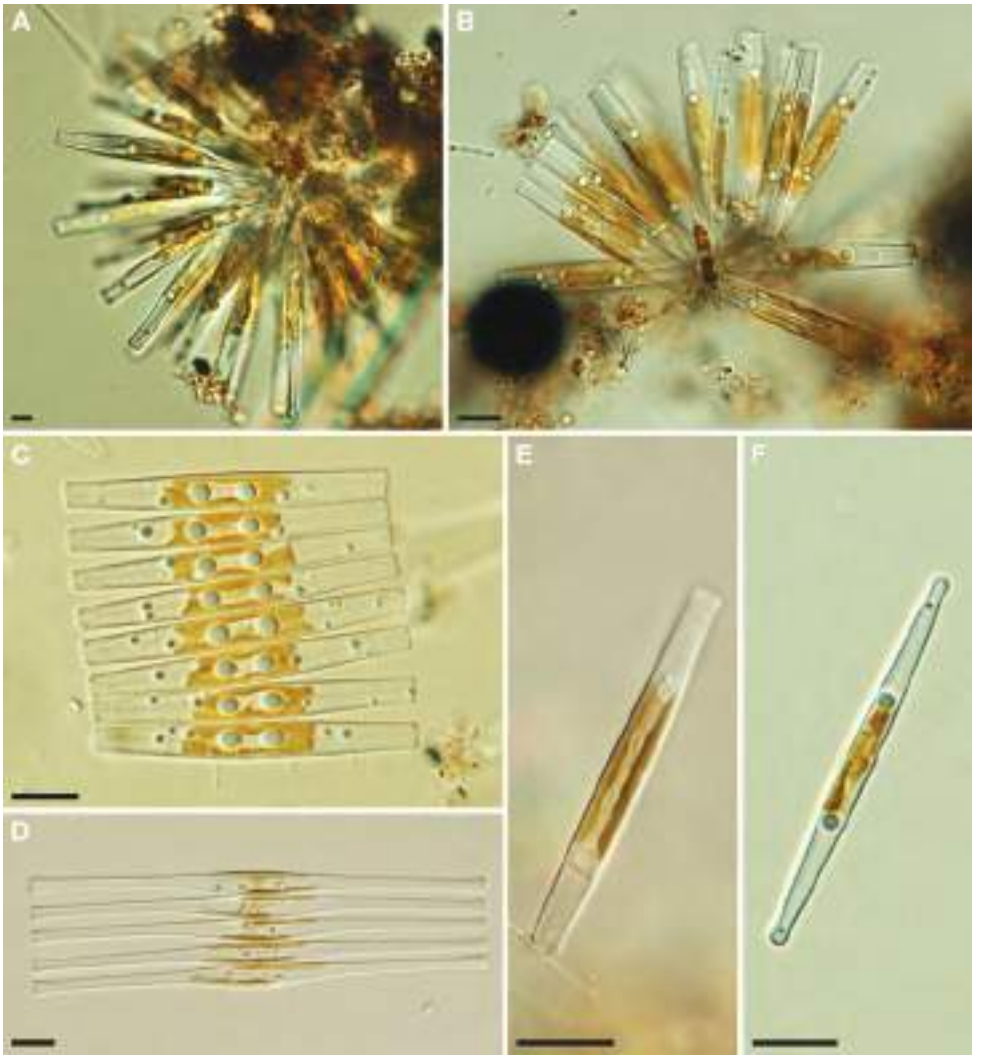


Fig. 38. *Fragilaria* spp. **A-F**. LM, living cells. **A-B**. Cells aggregated into colonies, joined at the base of the cells. **C**. Cells (girdle view) in a ribbon-like colony. **D**. *Fragilaria crotonensis* Kitton, girdle view, ribbon-like colony. **E**. Single cell, girdle view. **F**. Single cell, valve view.
Scale bars = 10 µm (A-F).

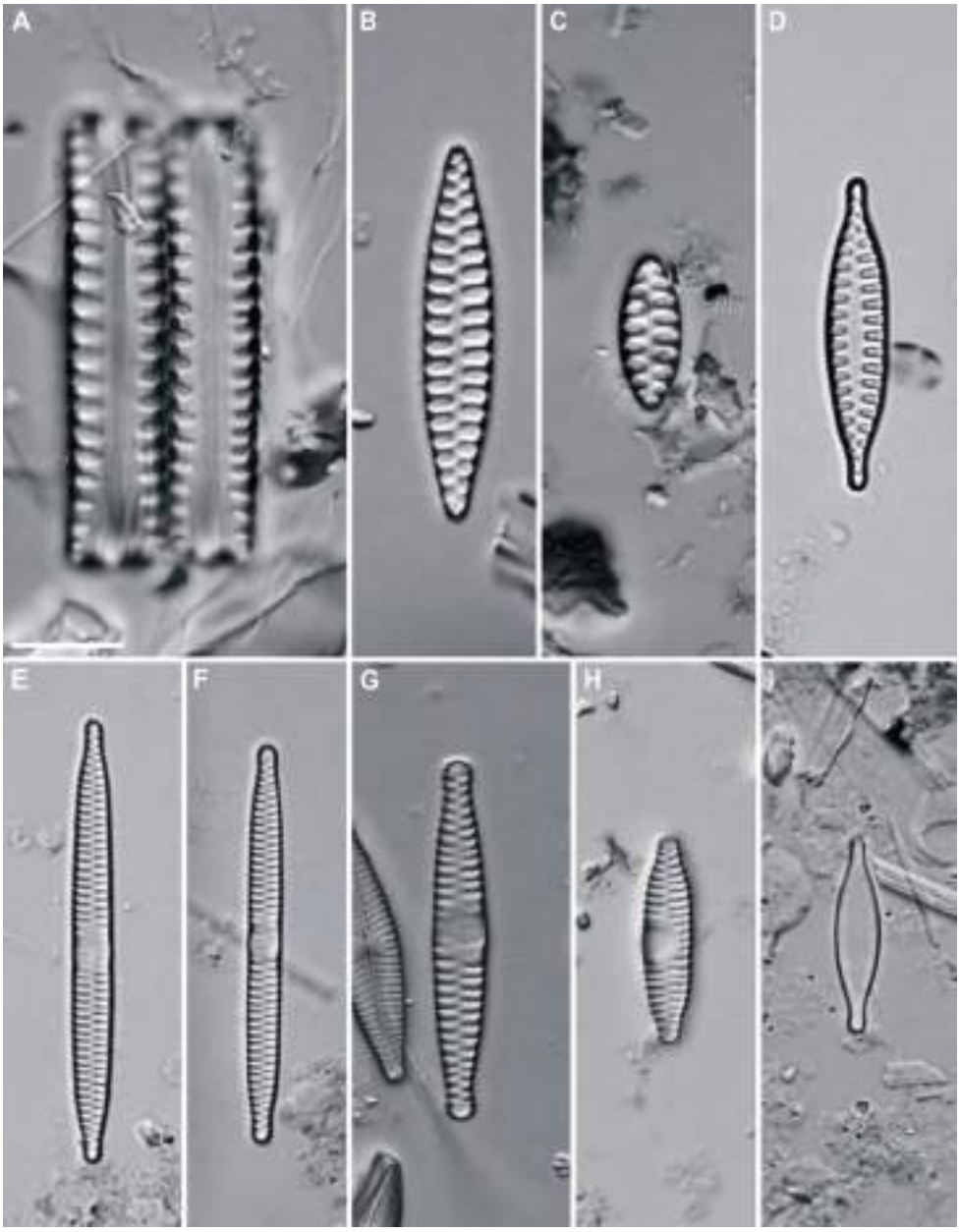


Fig. 39. *Fragilaria* spp. sensu lato. **A-I**. LM. **A**. Girdle view of two cells of *Fragilaria crassa* Metzeltin & Lange-Bertalot. **B-C**. Valve view of *F. crassa*. **D-H**. Valve views of *Fragilaria* spp. **I**. *F. densestriata* Hustedt.
Scale bar = 10 µm (A-H).

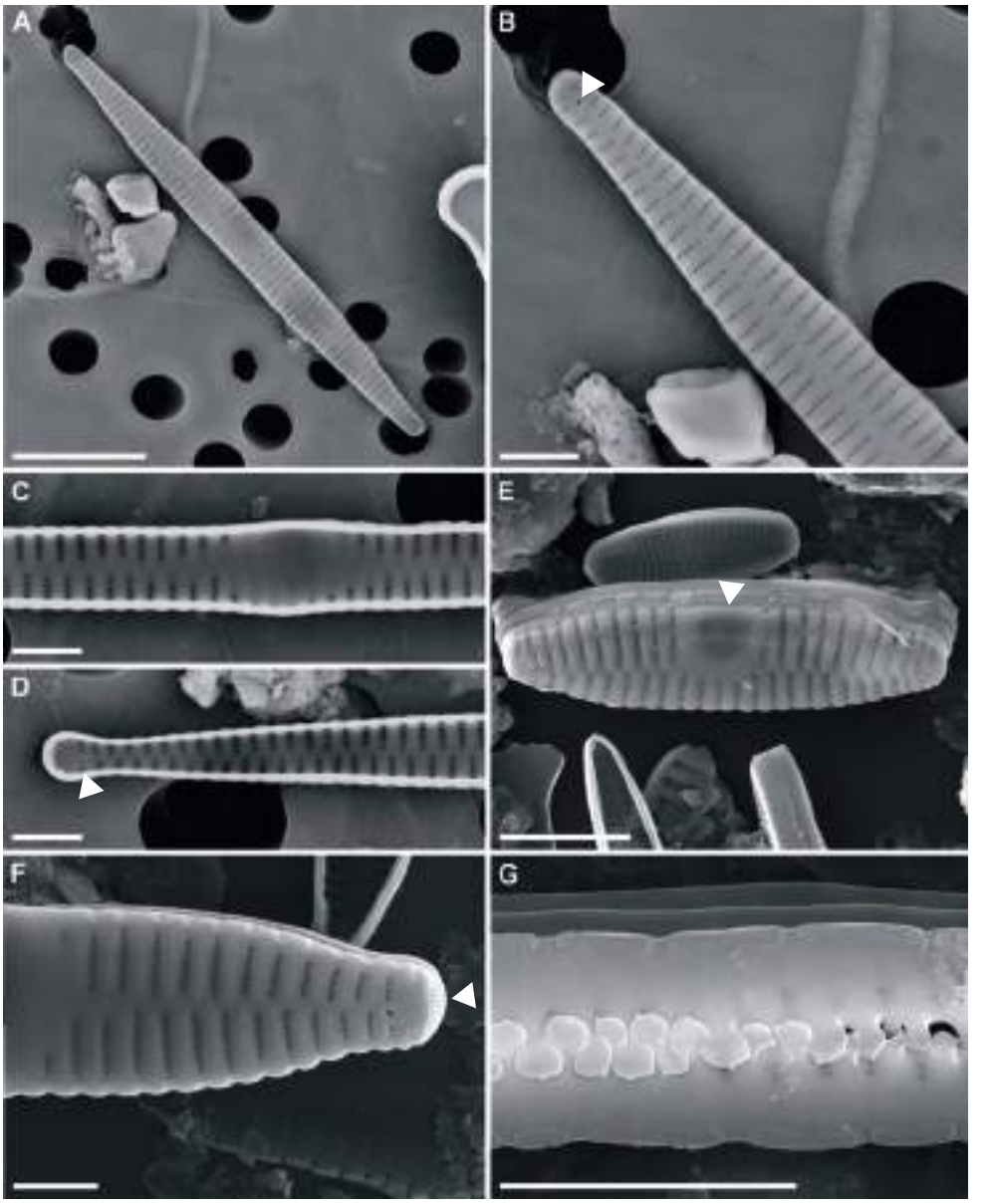


Fig. 40. *Fragilaria* spp. **A-G**. SEM. **A-B**. External view of valve, note external opening of rimoportula (arrow **- B**). **C-D**. Internal view of valves. **C.** Central area. **D**. Apex of cell, note internal opening of rimoportula (arrow). **E**. Oblique view of valve exterior, note thickened fascia (arrow). **F**. External view of cell apex, note apical pore field (arrow). **G**. Girdle view of two valves joined by interlinking spines. Scale bars = 8 µm (A), 2 µm (B-D, F), 5 µm (E, G).

Fragilariforma D.M. Williams & Round 1988

Type species: *Fragilariforma virescens* (Ralfs) D.M. Williams & Round

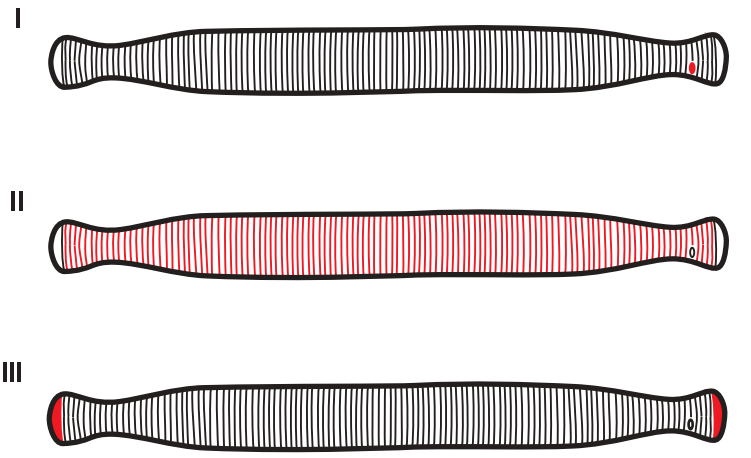
SYNONYM:
Fragilaria Lyngbye 1819 pro parte

Characteristics – Cells **araphid** with parallel striae through the length of the valve (I), areolae fine, not easily observed under LM (Fig. 41). **Rimoportula** (labiate or lipped process) present at one apex (I), difficult to observe under LM. Apical pore fields present at both apices, appearing as unornamented areas under LM (III). **Axial area** very narrow, not possible to observe with LM. Spines at the junction of the valve face and valve mantle (Fig. 42: A-B).

Plastid structure – Unknown from African material.

Identification of species – Up till now only one species known from tropical Africa: *Fragilariforma strangulata* (Zanon) D.M. Williams & Round.

Ecology – Cells joined valve face to valve face forming ribbon-like colonies. Found in the benthos of acidic, oligotrophic waters with low conductivity.



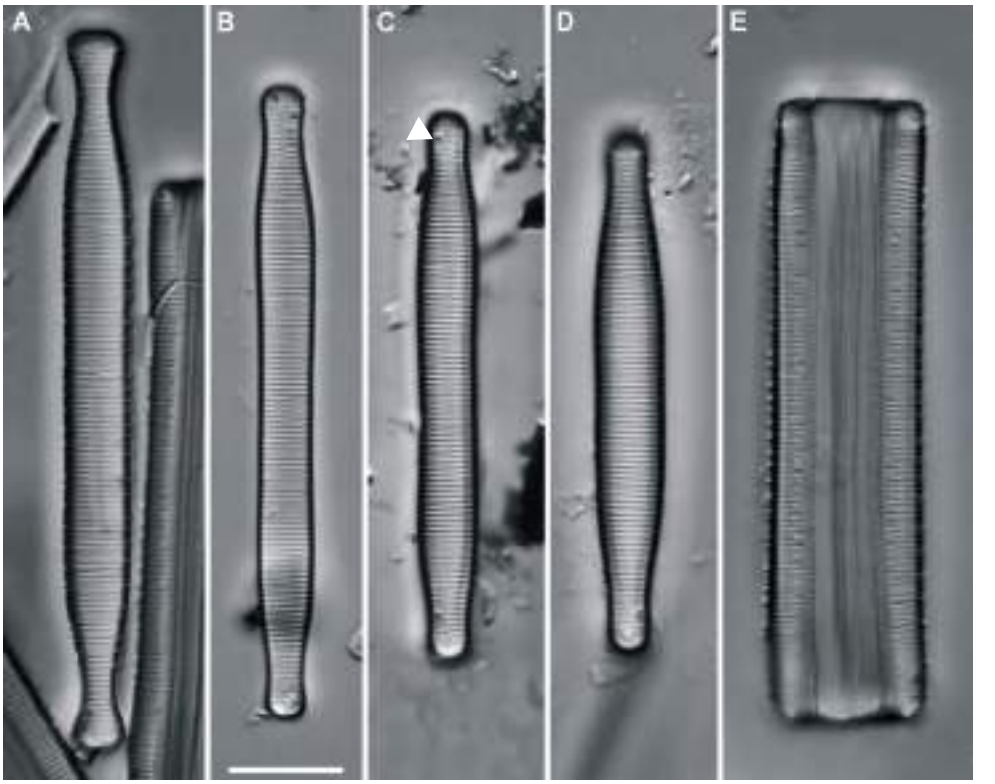


Fig. 41. *Fragilariforma strangulata* (Zanon) D.M. Williams & Round. **A-E.** LM. **A-D.** Valve views, note rimoportula (arrow - **C**). **E.** Girdle view. Scale bar = 10 µm.

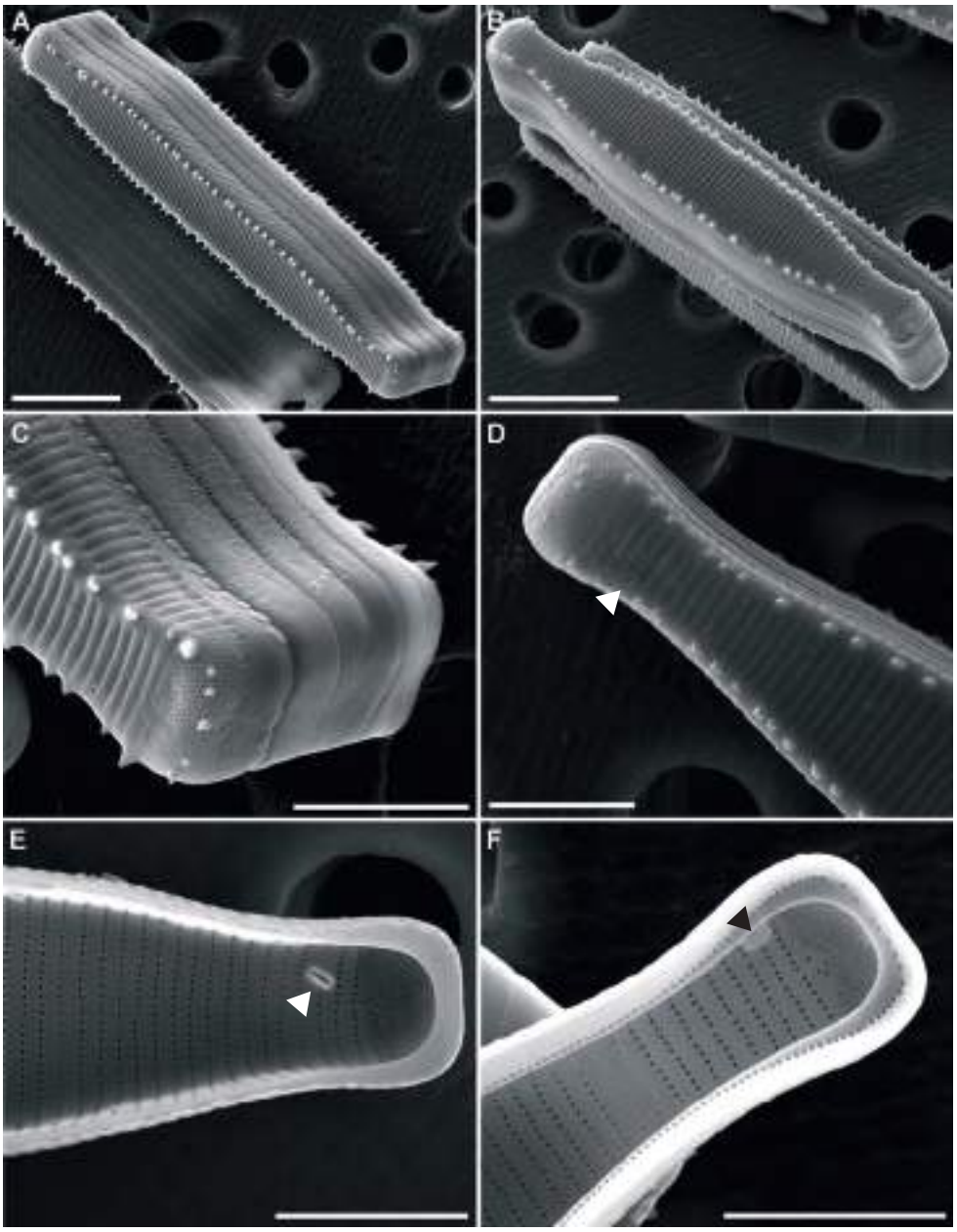


Fig. 42. *Fragilariforma strangulata*. **A-F.** SEM. **A-B.** Oblique external view of valves. **C-D.** External view of apices, showing apical pore field, note external opening of rimoportula (arrow - **D**). **E-F.** Internal view of apices showing variable position of rimoportulae (arrows).
Scale bar = 10 µm (A-B), 5 µm (C-F).

Meridion C. Agardh 1824

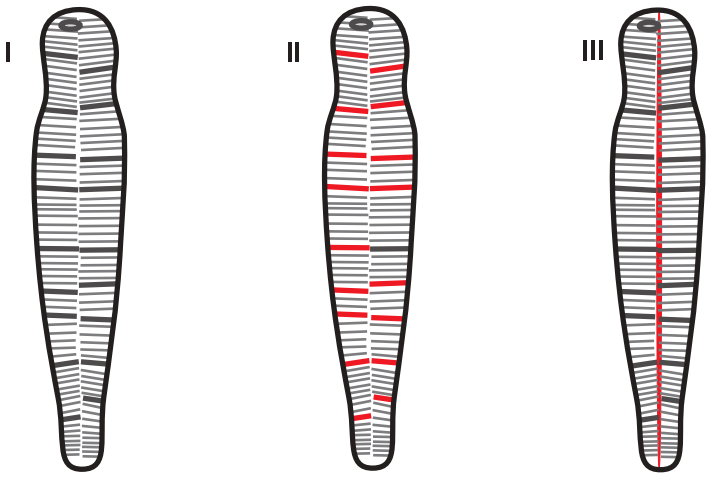
Type species: *Meridion vernale* C. Agardh

Characteristics – Cells **araphid**, **heteropolar** with broadly rounded head pole and narrower foot pole, wedge shaped in girdle view. Valve margin may be constricted just below the head pole. Valve face crossed by transapical striae and costae (II) interrupted in the centre by a narrow axial area (III). Striae are fine, located between the costae and not easily discernable under LM (Fig. 43: A-F). Single **rimoportula** present near the head pole (Fig. 44: A-B).

Plastid structure – Many discoid plastids lying under the valve face.

Identification of species – Up till now only one species known from tropical Africa: *Meridion circulare* (Greville) C. Agardh and *M. circulare* var. *constrictum* (Ralfs) Van Heurck.

Ecology – Cells solitary, or united by the valve faces forming fan-shaped colonies. Found in the benthos of acidic, oligotrophic waters with low conductivities.



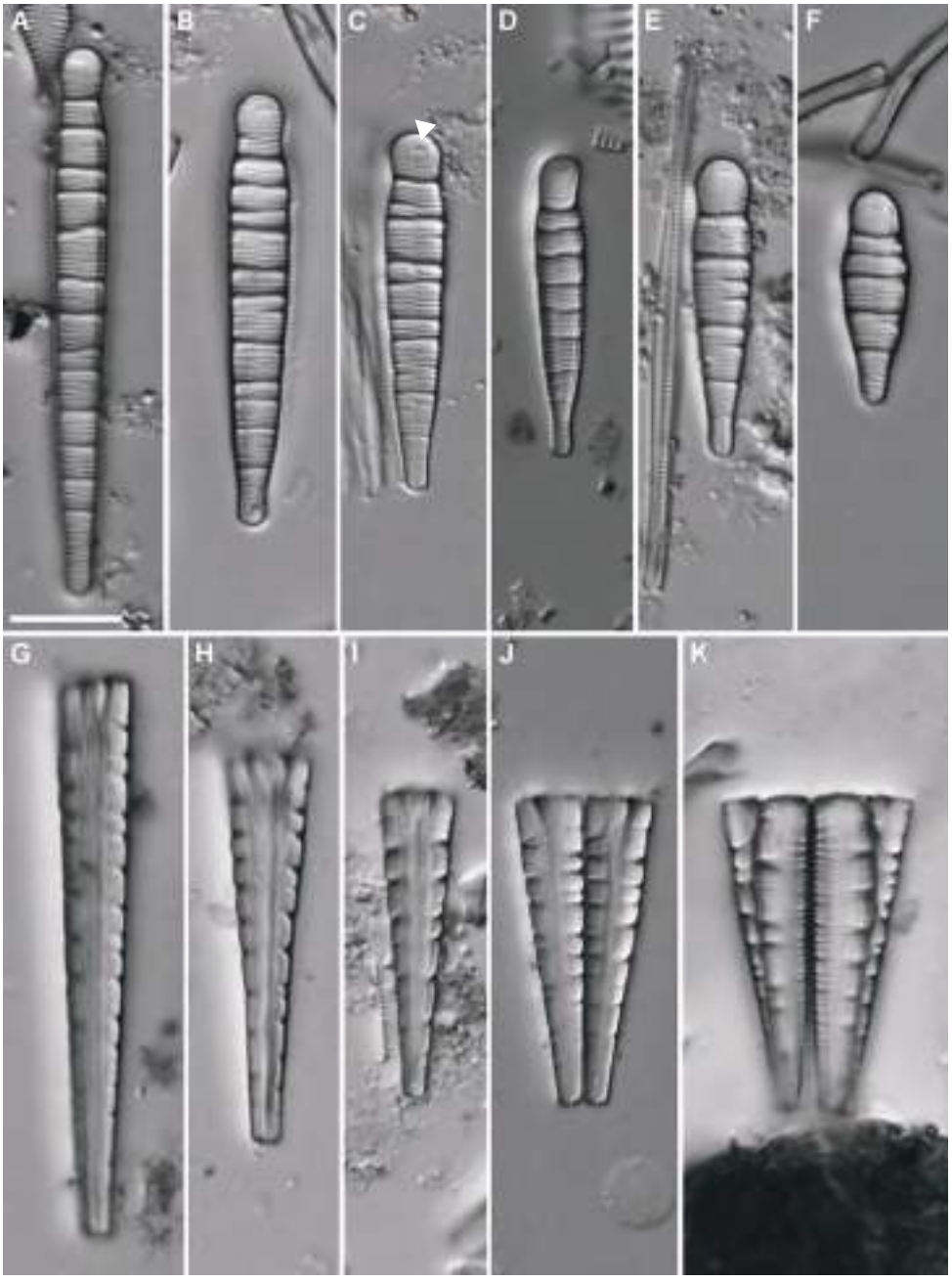


Fig. 43. *Meridion circulare* var. *constrictum*. **A-K**. LM. **A-F** Valve views, note rimoportula (arrow - **C**). **G-K.** Girdle views.
Scale bar = 10 µm .

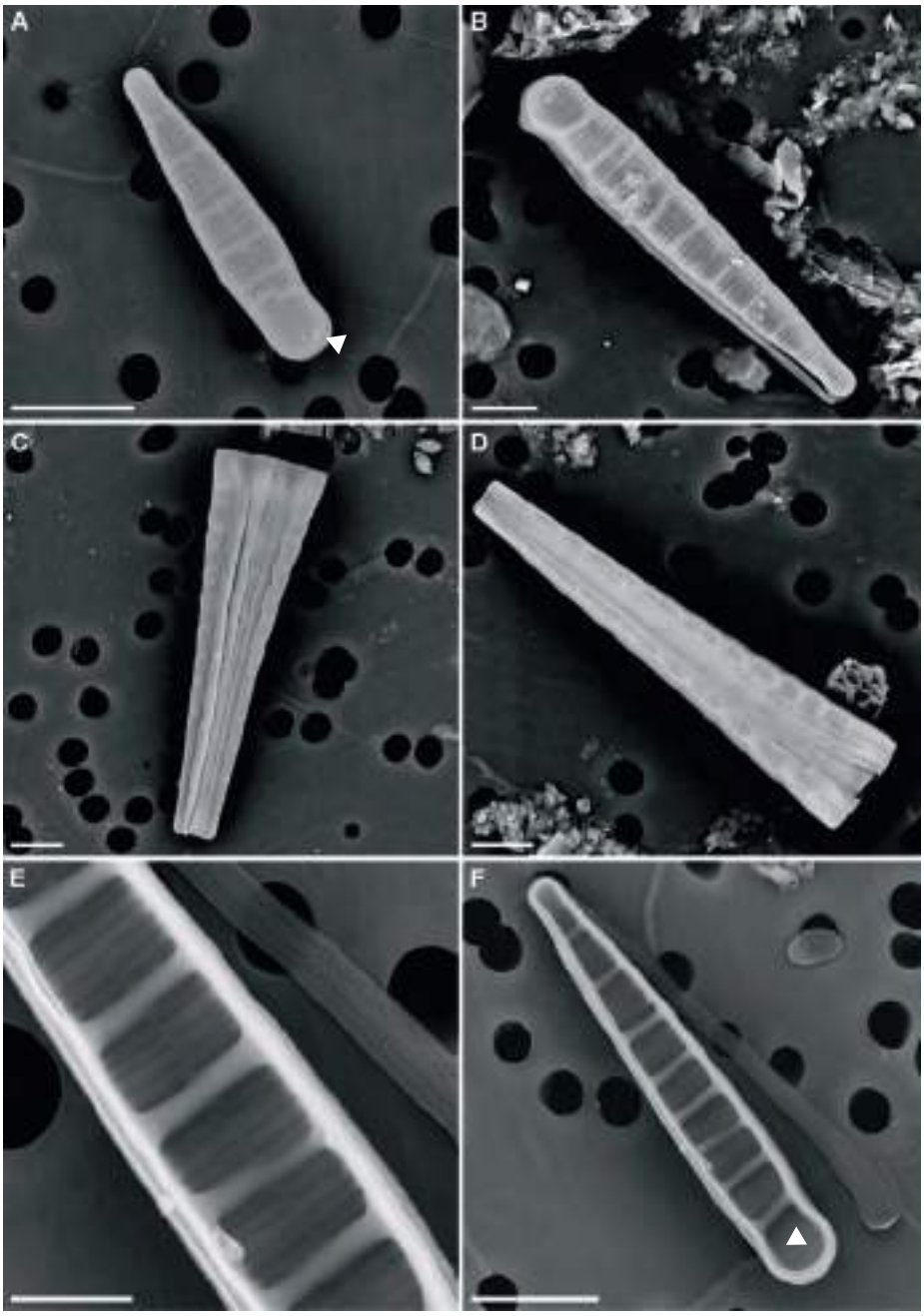


Fig. 44. *Meridion circulare* var. *constrictum*. **A-F**. SEM. **A-B.** External view of valve, note the rimoportula near the head pole apical (arrow **- A**). **C-D.** External view of girdle. **E-F.** Internal view of valve, note the internal opening of the rimoportula (arrow **- F**).
Scale bars = 10 µm (A-D), 3 µm (E), 8 µm (F).

Pseudostaurosira D.M. Williams & Round 1987

Type species: *Pseudostaurosira brevistriata* (Grunow) D.M. Williams & Round

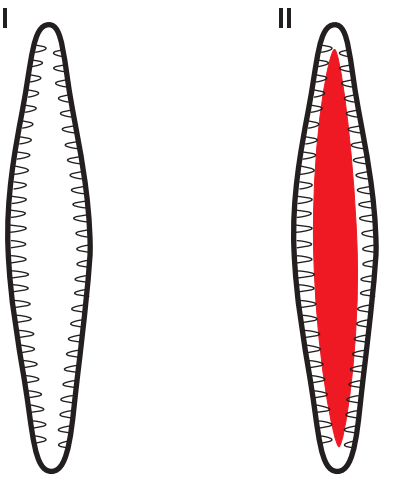
SYNONYM:
Fragilaria Lyngbye 1819 pro parte
Odontella C. Agardh 1832 pro parte

Characteristics – Cells **araphid** with short parallel striae through the length of the valve, areolae fine, not easily observed under LM (Fig. 45). **Axial area** broad, lanceolate. Spines may be present on junction of the valve face and valve mantle. Apical pore field at each pole.

Plastid structure – Cells with plate-like plastids one lying under each valve face (see *Fragilaria*).

Identification of species – Species can be identified by cell size, cell shape, structure and density of the striae as well as structure and extent of the axial area.

Ecology – Cells colonial, valve face to valve face forming ribbons or basally attached. Found in the benthos of waters with low to high conductivity and at a range of trophic levels.



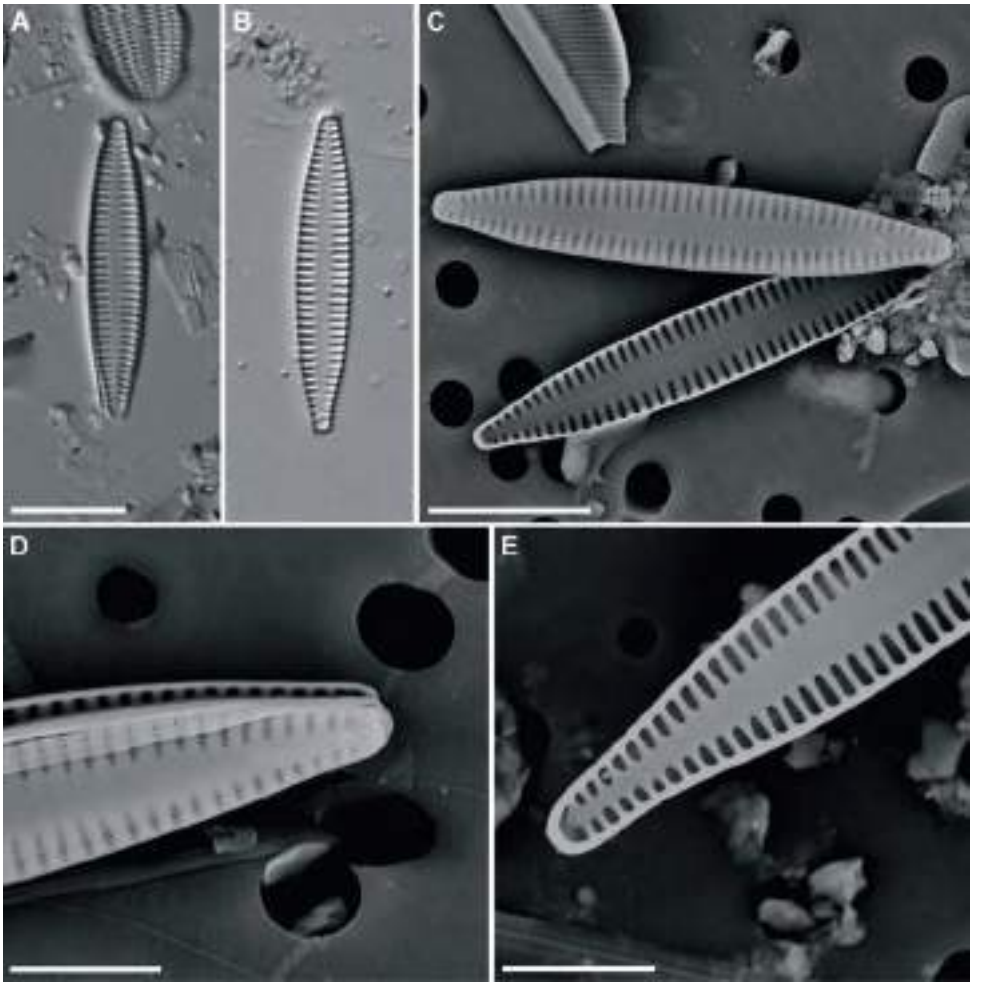


Fig. 45. *Pseudostaurosira brevistriata*. **A-B**. LM, valve view. **C-E.** SEM. **C.** External and internal view of valve. **D.** External view of valve apex. **E.** Internal view of valve apex.
Scale bars = 10 µm (A-C), 3 µm (D), 5 µm (E).

Staurosira Ehrenberg 1843

Type species: *Staurosira construens* Ehrenberg

SYNONYM:

Fragilaria Lyngbye 1819 pro parte

Characteristics – Cells **araphid**, elliptical or cruciform with robust parallel to radiate striae (II) through the length of the valve, areolae round to slightly elongate (Fig. 47: O-P), not easily observed under LM (Fig. 47: A-G, I-N). **Axial area** of variable width. Apical pore fields at one or both apices. Rimoportula absent. Spines present at the junction of the valve face and mantle. Distinguished from *Staurosirella* by the structure of the areolae (rounded).

Plastid structure – Cells with 2 plate-like plastids lying along the girdle (Fig. 46).

Identification of species – Species can be identified by cell size, cell shape, structure and density of the striae as well as structure and extent of the axial area.

Ecology – Cells colonial, linked valve face to valve face by spines forming ribbons (Fig. 46: A-B). Found in the benthos of waters with low to moderate conductivity and at a range of trophic levels.

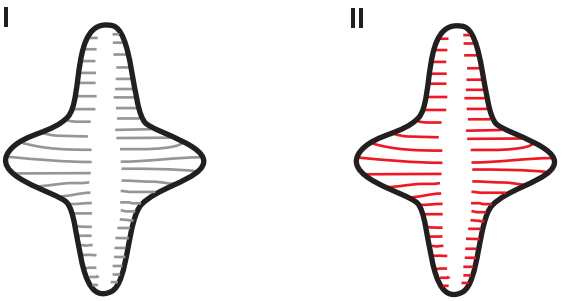


Fig. 46. *Staurosira construens*. **A-D.** LM, living cells. **A-B, D.** Cells linked valve face to valve face forming ribbon colonies. **C.** Valve view (right) and girdle view (above).
Scale bars = 10 µm.

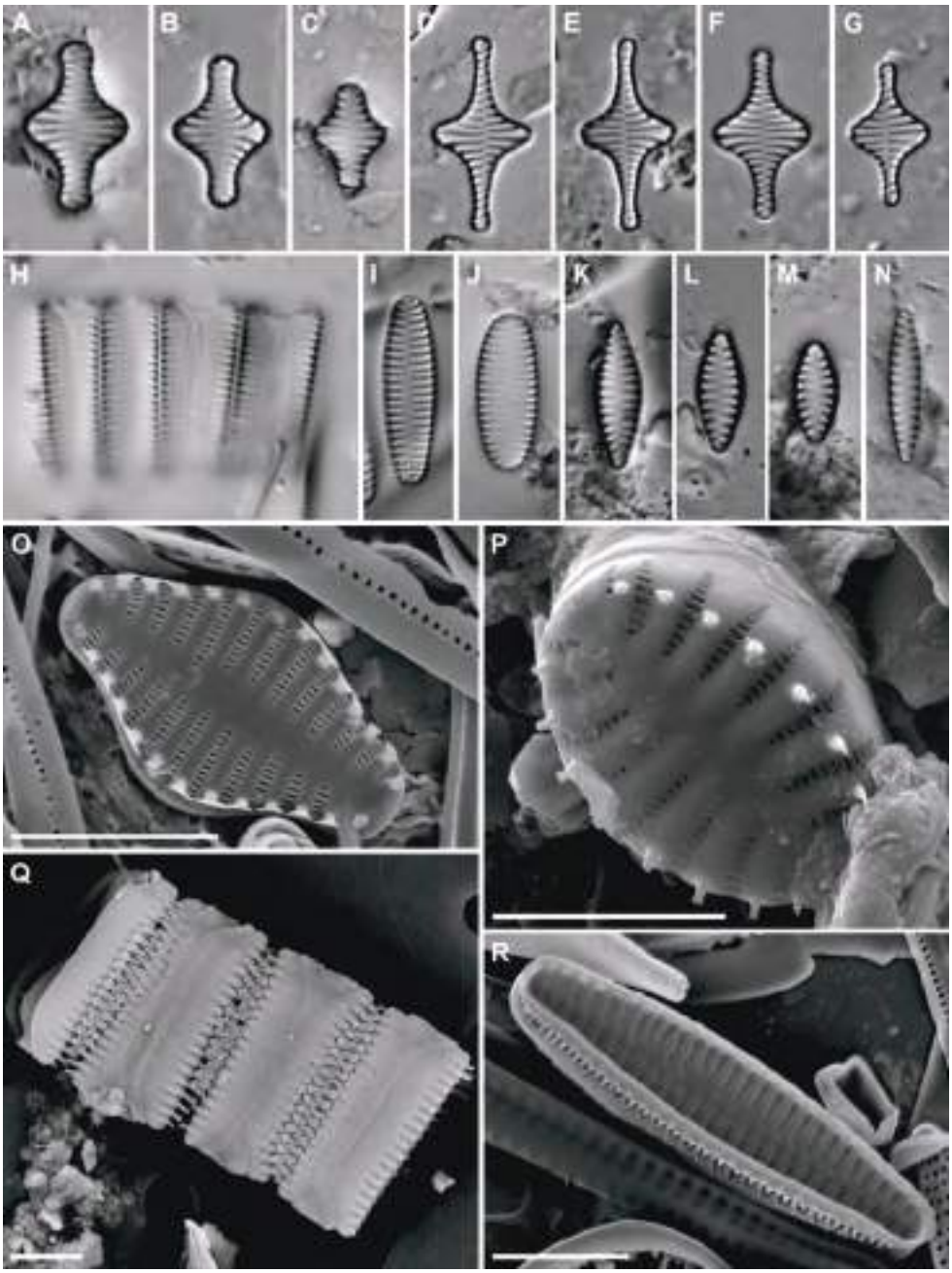


Fig. 47. *Staurosira* spp. **A-N.** LM, cleaned valves. **A-G, I-N.** Valve views. **H.** Girdle view. **O-R.** SEM. **O-P.** External view of valves, note the slightly elongated areolae. **Q.** Girdle view, showing spines at junction of valve face and mantle, forming ribbon colonies. **R.** Internal view of valve.
Scale bars = 10µm (A-N), 5 µm (O), 4µm (P-Q).

Staurosirella D.M. Williams & Round 1987

Type species: *Staurosirella lapponica* (Grunow) D.M. Williams & Round

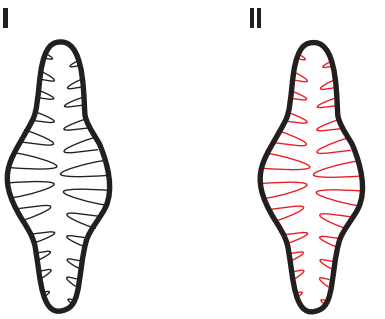
SYNONYM:
Fragilaria Lyngbye 1819 pro parte

Characteristics – Cells **araphid**, elliptical, linear or cruciform with robust parallel striae (II) through the length of the valve, areolae **lineolate** (Fig. 48: K), not easily observed under LM (Fig. 48: A-I). **Axial area** of variable width. Apical pore field at one or both apices. Rimoportula absent. Spines present at the junction of the valve face and mantle. Distinguished from *Staurosira* by the structure of the areolae (elongate).

Plastid structure – Cells with 2 plate-like plastids lying along the girdle (Fig. 48: A).

Identification of species – Species can be identified by cell size, cell shape, structure and density of the striae as well as structure and extent of the axial area.

Ecology – Cells colonial, linked valve face to valve face by spines forming ribbons. Found in the benthos of waters with low to moderate conductivity and at a range of trophic levels.



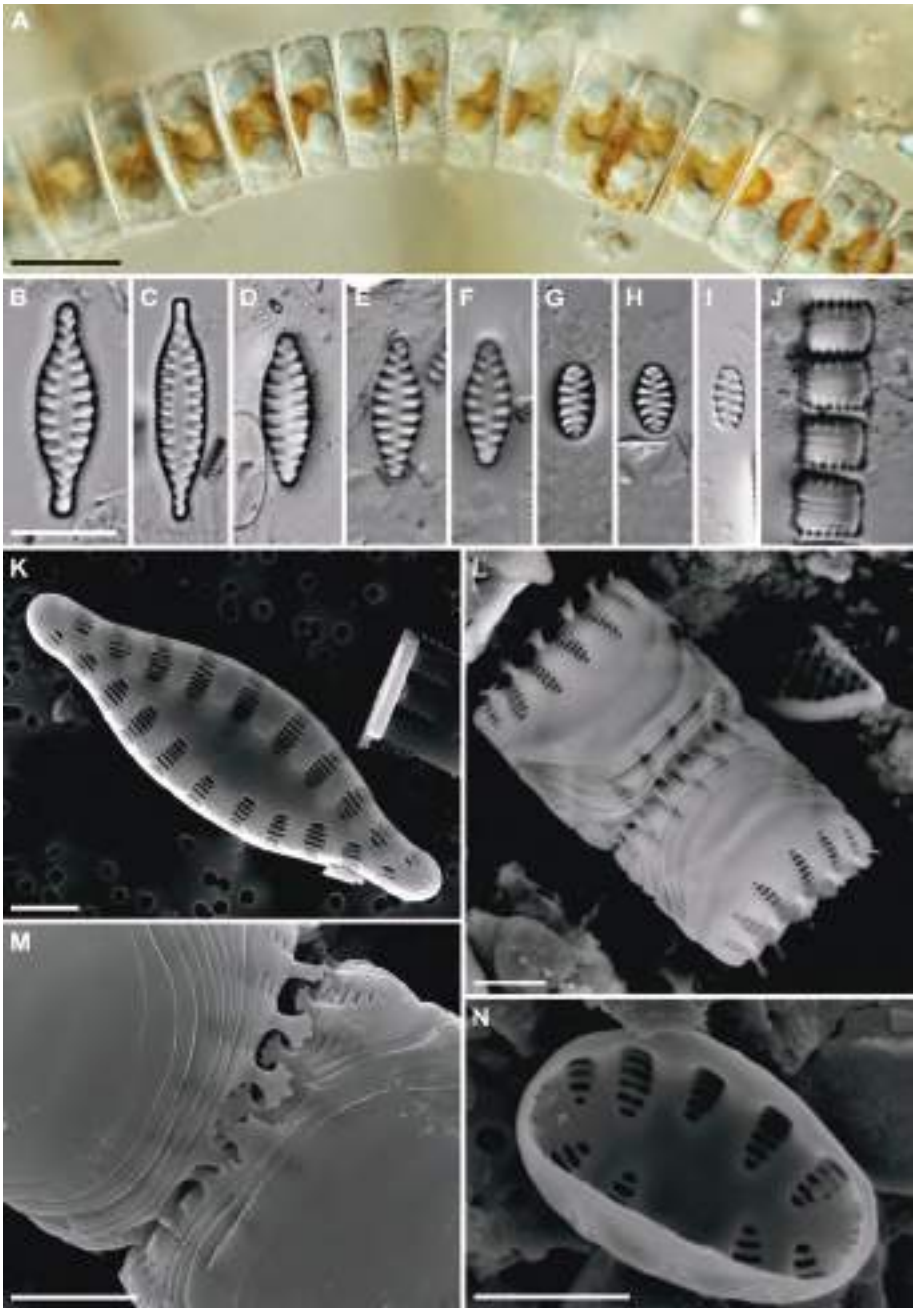


Fig. 48. *Staurosirella* spp. **A-J.** LM. **A.** Living cells. **B-J.** Cleaned valves. **B-I.** Valve views. **J.** *S. pinnata* (Ehrenberg) D.M. Williams & Round, girdle view. **K-N.** SEM. **K.** External view of valve, note the lineolate areolae. **L-M.** Girdle views, note the connecting spines. **N.** Internal view of valve.
Scale bars = 10 µm (A-J), 2 µm (K-N).

Tabularia Kützing ex D.M. Williams & Round 1986

Type species: *Tabularia barbatula* (Kützing) D.M. Williams & Round

SYNONYM:
Fragilaria Lyngbye 1819 pro parte
Synedra Ehrenberg 1830 pro parte

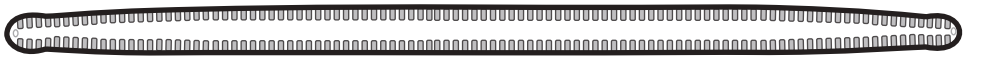
Characteristics – Cells **araphid**, linear with parallel striae through the length of the valve, areolae fine, not easily observed under LM (Fig. 49: A). **Axial area** broad. **Rimoportula** (labiate or lipped process) present at both apices (II; Fig. 49: B, D). Apical pore field at each pole.

Plastid structure – Cells with plate-like plastids one lying under each valve face (see *Fragilaria*).

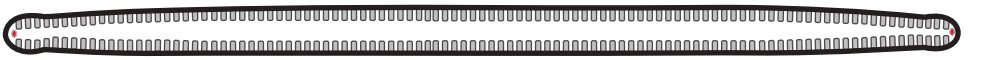
Identification of species – Species can be identified by cell size, cell shape, structure and density of the striae as well as structure and extent of the axial and central area.

Ecology – Cells colonial, basally attached. Found in the benthos of waters with moderate to high conductivity and at a range of trophic levels.

I



II



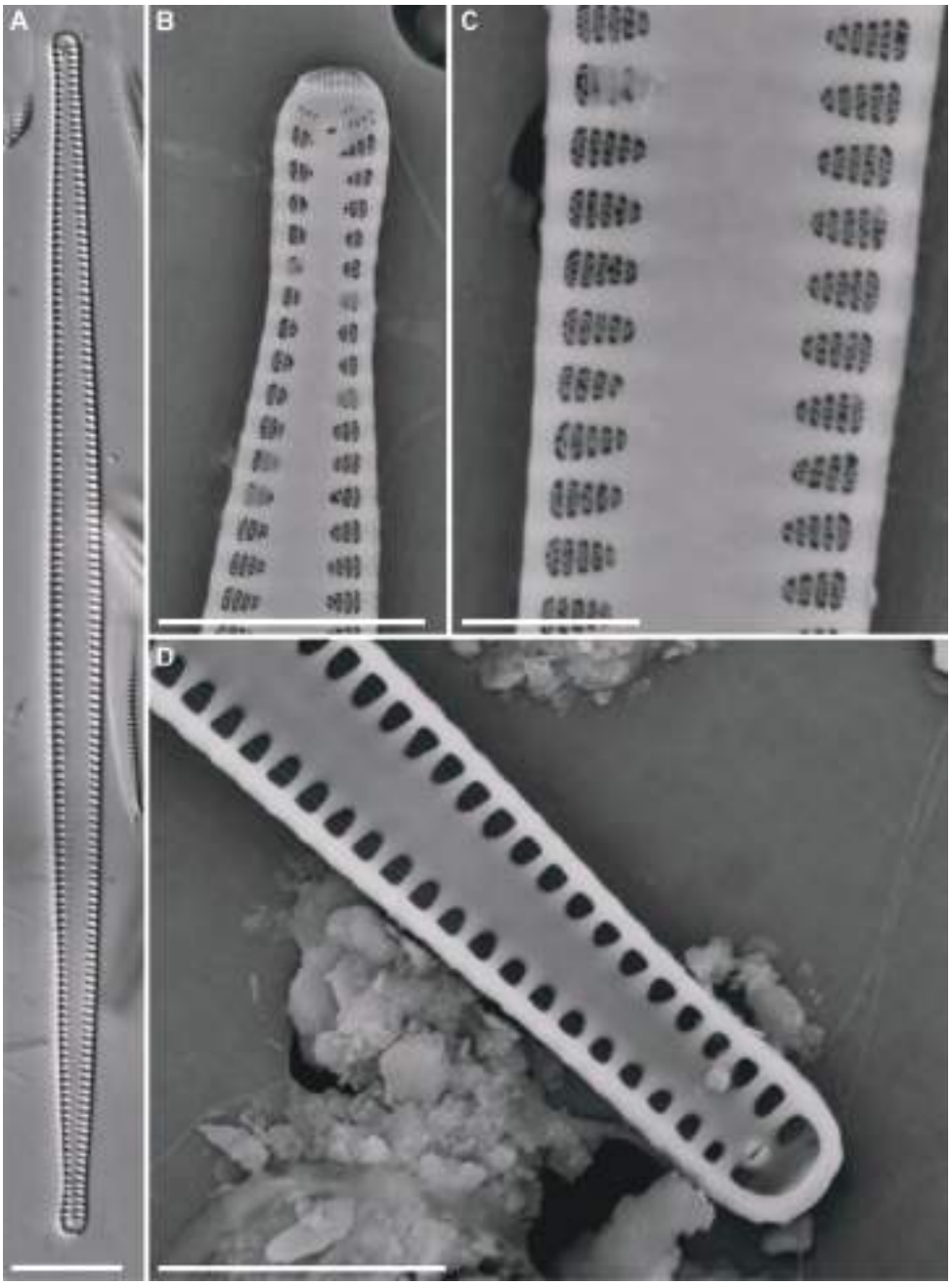


Fig. 49. *Tabularia fasciculata* (C. Agardh) D.M. Williams & Round. **A**. LM. **B-D**. SEM, internal view of valve, note position of internal opening of rimoportula. Scale bars = 10 µm (A), µm 5 µm (B, D), 2 µm (C).

Ulnaria (Kützing) Compère 2001

Type species: *Ulnaria ulna* (Nitzsch) Compère

SYNONYM:

Synedra Ehrenberg 1830 pro parte

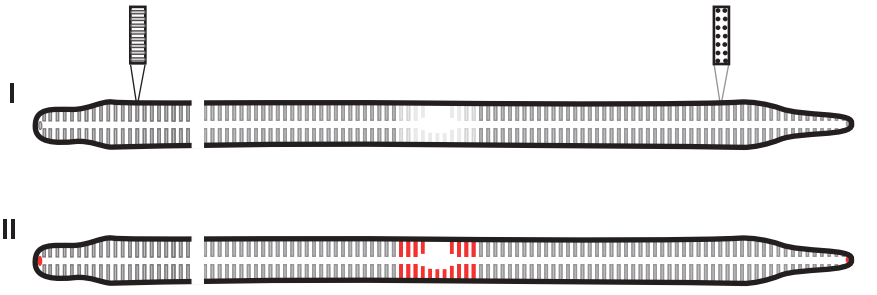
Characteristics – Cells **araphid**, often very long with parallel striae through the length of the valve, areolae fine and often not easily observed under LM (Fig. 52). **Axial area** narrow but clearly discernable. Central area may be present and varies in size (Fig. 52), may reach both valve margins (Fig. 52: B) or be unilaterally expanded (Fig. 52: C-D). Ghost striae may be present (II; Fig. 52: A, D). **Rimoportula** (labiate or lipped process) present at both apices (II). Small apical spines may be present (Fig. 53: A).

Plastid structure – Cells with 2 plate-like plastids lying under the valves (Fig. 51: D).

Identification of species – Species can be identified by cell size, cell shape, structure and shape of the apices, structure and density of the striae as well as structure and extent of the axial and central area.

Ecology – Cells planktonic or colonial, basally attached (Fig. 50). Found in the benthos of waters with low to moderate conductivities and at a range of trophic levels. Thought to be adapted to survive high flow conditions.

Notes – The genus ***Synedra*** sensu lato will often be encountered in older literature. This genus contained number of species common to tropical African waters (e.g. *Synedra nyansae* G.S. West, synonym *S. dorsiventralis* O. Müller). The type of *Synedra* is now considered to be *S. gaillonii* (Bory) Ehrenberg which is a marine species. Most freshwater species from *Synedra* senu lato have now been transferred to *Ulnaria, e.g. Ulnaria nyansae* (G.S. West) D.M. Williams.



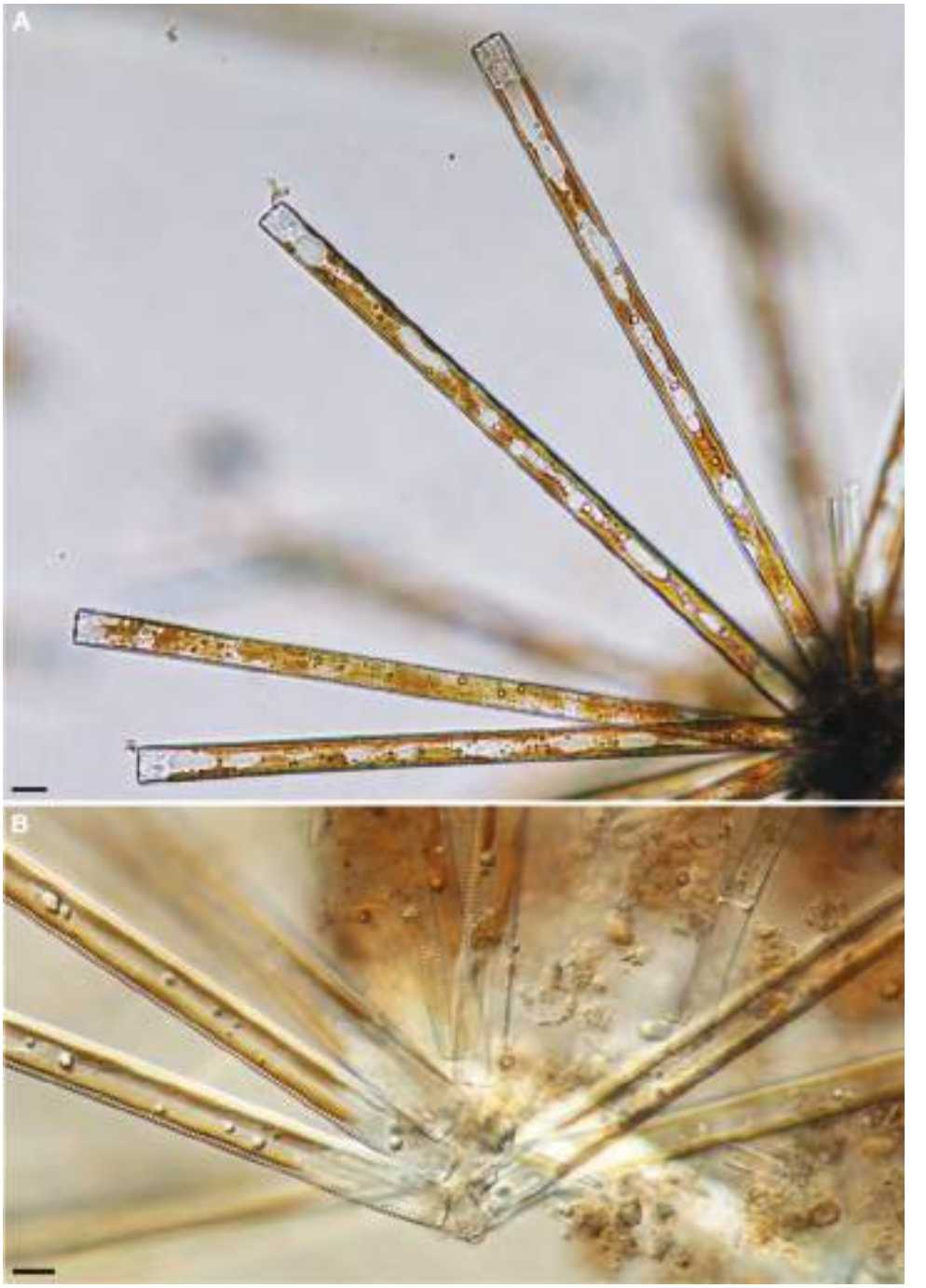


Fig. 50. *Ulnaria* spp. **A-B.** LM, living cells, girdle view, forming colony, cells basally attached.
Scale bars = 10 µm.

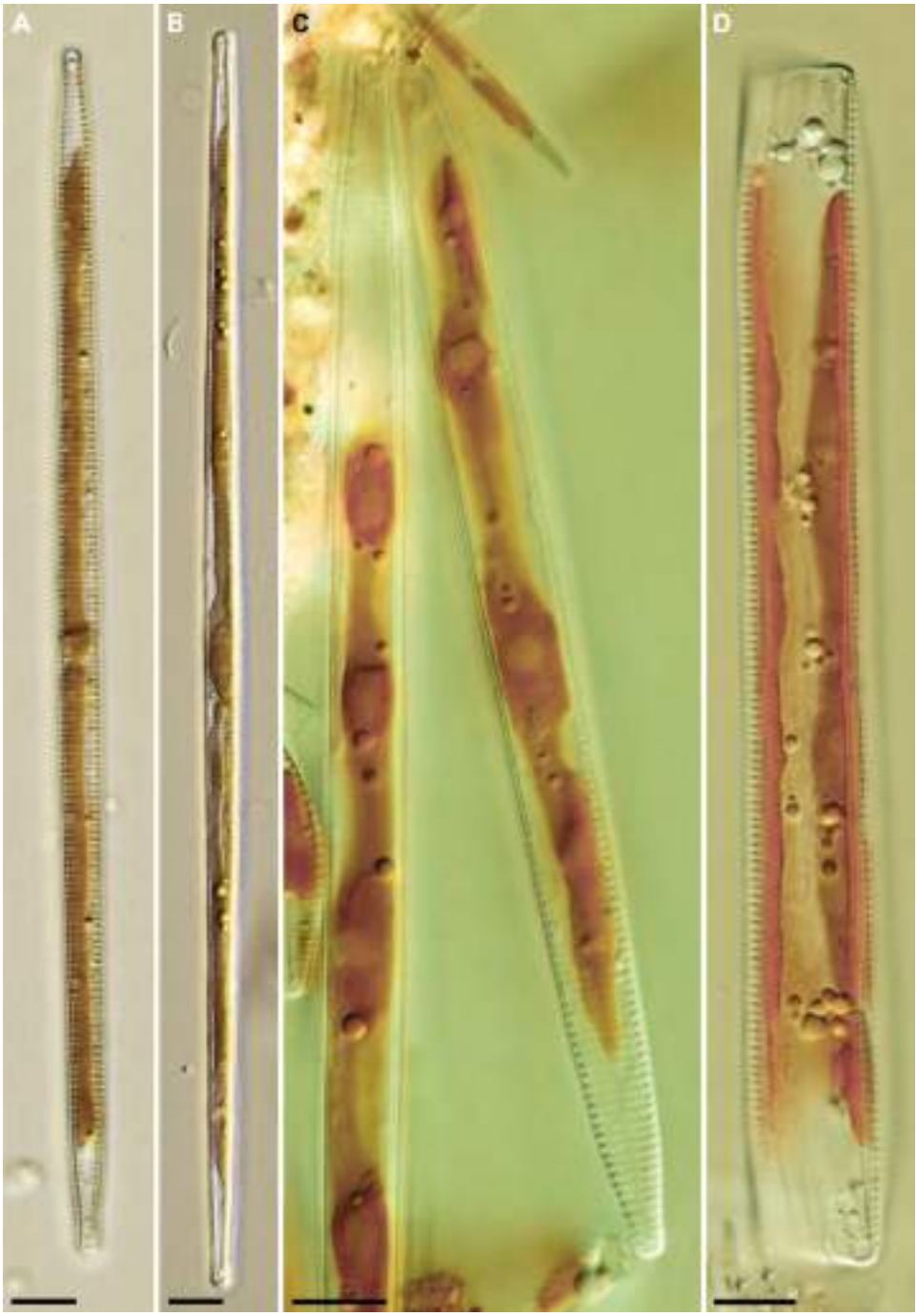


Fig. 51. *Ulnaria* spp. **A-D.** LM, living cells. **A-B.** Valve views. **C.** Valve views, forming colony, cells basally attached. **D.** Girdle view.
Scale bars = 10 µm.

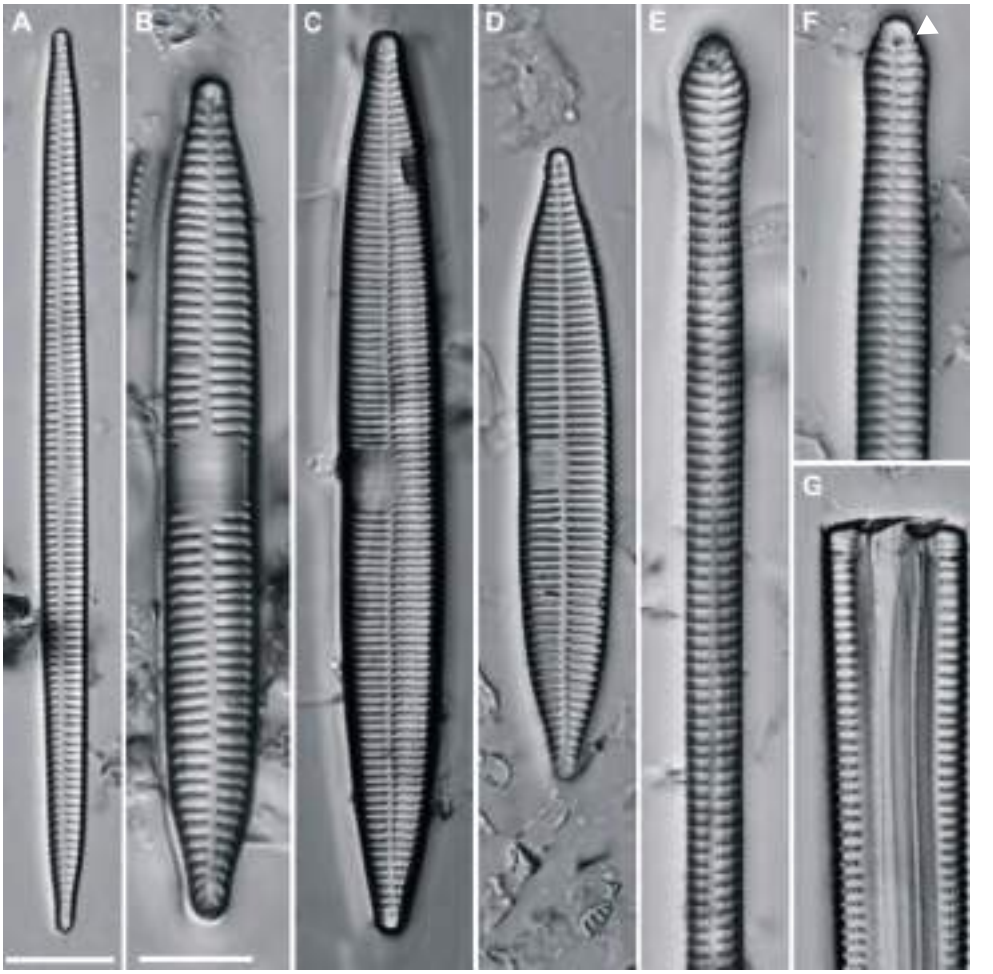


Fig. 52. *Ulnaria* spp. **A-G.** LM. **A-B.** Valve views. **C-D.** Valve views of *Ulnaria nyansae*. **E-F.** Valve views, note rimoportula (arrow - **F**). **G.** Girdle view. Scale bars = 10 µm.

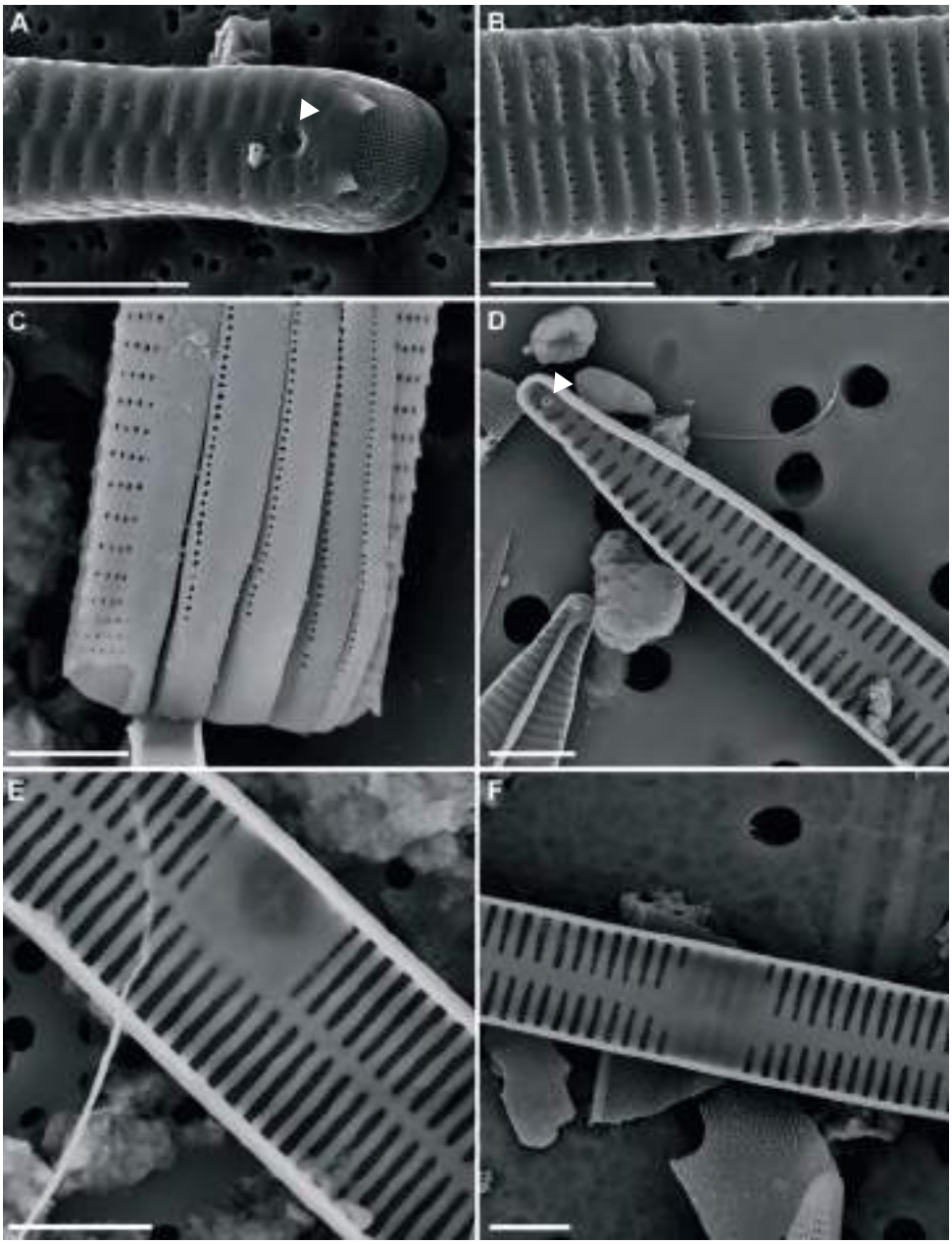


Fig. 53. *Ulnaria* spp. **A-F.** SEM. **A-B.** External view of valve**. A.** Cell apex, note apical pore field and rimoportula (arrow). **C.** External girdle view. **D-F.** Internal view of valve. **D.** Cell apex with internal opening of rimoportula (arrow). **E-F.** Central area, varies in size and may reach both valve margins. Scale bars = 5 µm (A-F).

Tabellaria (Ehrenberg) Kützing 1844

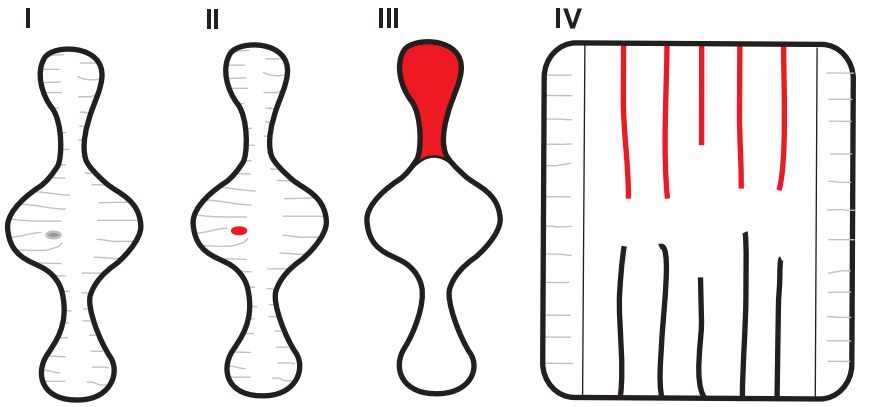
Type species: *Tabellaria flocculosa* (Roth) Kützing

Characteristics – Cells **araphid** with swollen mid-valve and apices. Parallel striae through the length of the valve, areolae fine, not easily observed under LM (Fig. 54: C, E-F). **Axial area** very narrow, a reduced central area may be present. **Rimoportula** (labiate or lipped processes) present mid-valve (II), positioned slightly eccentrically. Apical pore fields at both poles (Fig. 55: A). Numerous girdle bands or **copulae** bear **septa** (III), visible in both valve view (III) and girdle view (IV) (Fig. 54: D; Fig. 55: B, E). Spines may be present at the junction of the valve face and mantle (Fig. 55: A).

Plastid structure – Cells with numerous discoid plastids (Fig. 54: A-B).

Identification of species – Species can be identified by cell size (length), cell shape, presence of a central area, presence of spines as well as the height of complete frustules in girdle view.

Ecology – Cells colonial, joined at the apices of the cells by mucilage pads forming zigzag colonies (Fig. 54: A-B). Found in the benthos of slightly acidic oligotrophic waters with low conductivities, may be re-suspended in the phytoplankton.



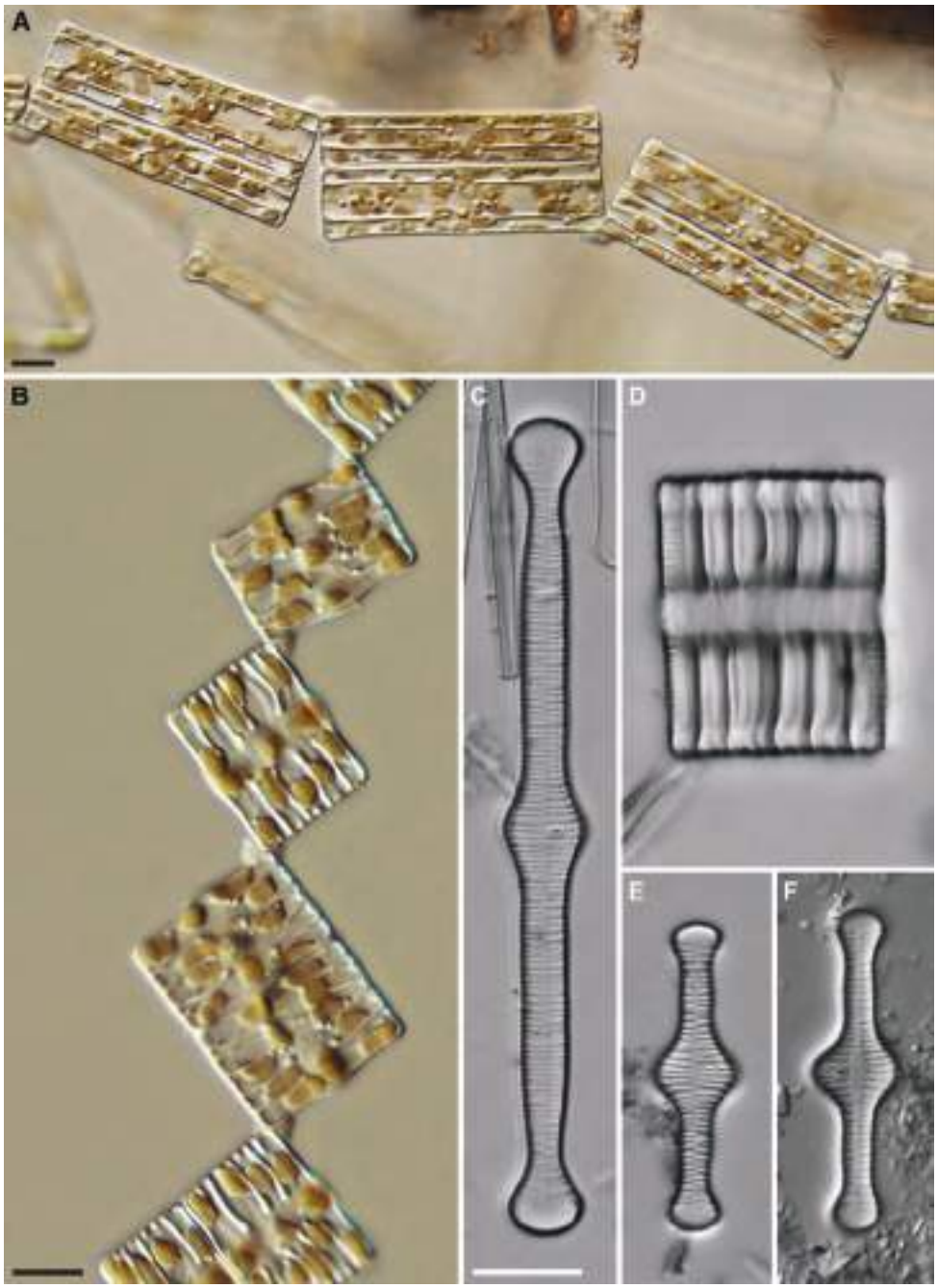


Fig. 54. *Tabellaria* spp. **A-F.** LM. **A-B.** Living cells forming zigzag colonies. **C-F.** Cleaned cells. **C, E-F.** Valve views. **D.** Girdle view. **A, C.** *T. fenestrata* (Lyngbye) Kützing. **B, D, F.** *T. flocculosa.*
Scale bars = 10 µm .

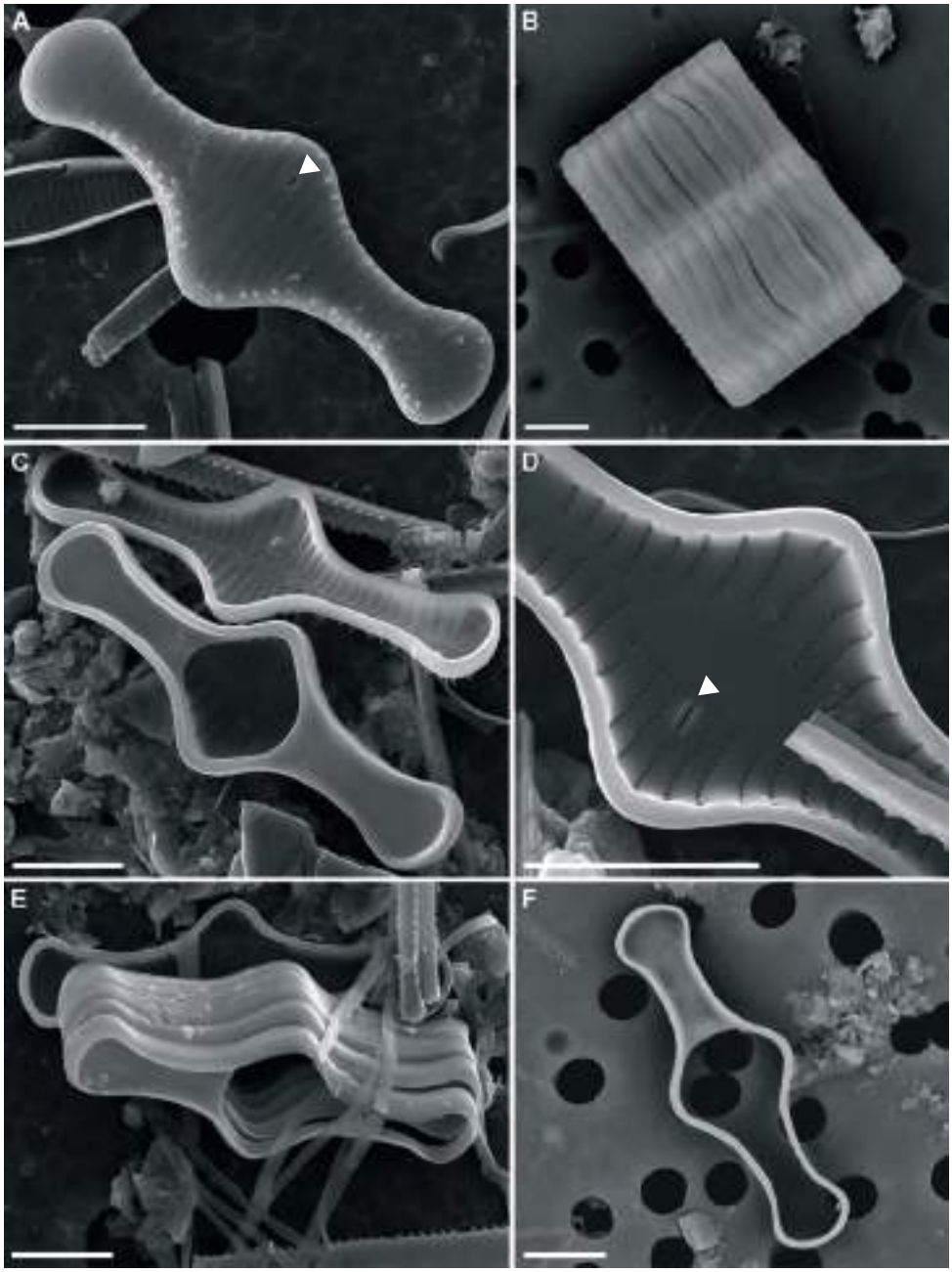


Fig. 55. *Tabellaria flocculosa*. **A-F.** SEM. **A.** External view of valve, note position of the rimoportula (arrow). **B.** Girdle view. **C, E-F.** Internal view of valve showing the septa. **D.** Internal view of valve, note internal opening of rimoportula (arrow).
Scale bars = 5 µm .

Actinella F.W. Lewis 1864

Type species: *Actinella punctata* F.W. Lewis

Characteristics – Cells raphid, usually strongly **heteropolar** (head pole differs in size and shape from foot pole) and this is the chief character differentiating this genus from *Eunotia*. The cell margins have **spines** and the head or larger pole (Fig. 57: F) as well as the foot pole (Fig. 57: G) may carry a single isolated **spine** (I). The raphe is very short on the valve face (comparable to *Eunotia*) with the majority of the length being found on the **valve mantle** (Fig. 57). In girdle view cells have a pronounced wedge shape (Fig. 57: B). A single **rimoportula** (labiate or lipped process) is present at each apex which may be rather difficult to see in LM (II, Fig. 57: A).

Plastid structure – Cell occupied by a single large chloroplast the lobes of which are apressed under each valve and connected centrally by a bridge (Fig. 56: D).

Identification of species – Species and varieties in this genus are distinguished based on cell size and shape and importantly the shape of the apices.

Ecology – Cells solitary. Found in acidic oligotrophic waters.

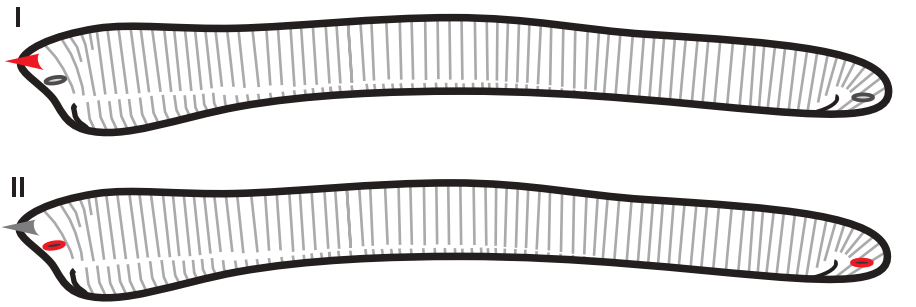


Fig. 56. *Actinella* spp. **A-D**. LM, living cells. **A-C.** *Actinella brasiliensis* Grunow valve view. **D**. *A. brasiliensi*s girdle view.
Scale bars = 10 µm (A-D).

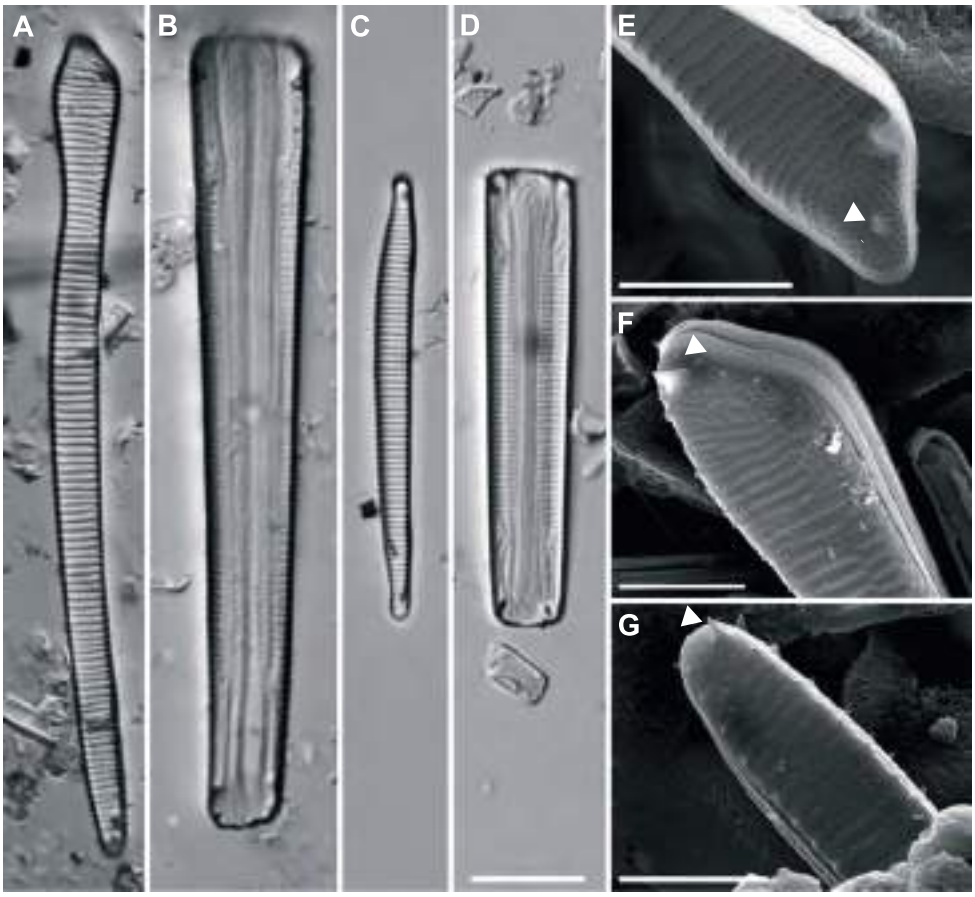


Fig. 57. *Actinella* spp. **A-D**. LM. **A**. *Actinella brasiliensis* valve view. **B**. *A. brasiliensis* girdle view. **C**. *Actinella* sp. valve view. **D**. *Actinella* sp. girdle view. **E-G**. SEM. **E**. Internal view of valve showing rimoportula near head pole (arrow). **F**. Head pole, note position of external opening of rimoportula (arrow). **G**. External view of foot pole, note the single large spine near the apex (arrow). Scale bars = 10 µm (A-D), 5 µm (E-G).

Actinellopsis J.C. Taylor, B. Karthick & Kociolek 2014

Type species: *Actinellopsis murphyi* J.C. Taylor, B. Karthick & Kociolek

SYNONYM:

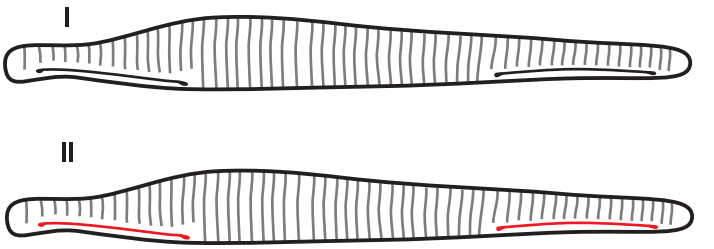
Actinella F. W. Lewis 1864 pro parte

Characteristics – Cells raphid, **heteropolar** (head pole differs in size and shape from foot pole) as well as being **dorsiventral** with a rounded dorsal and flattened ventral margin (I). Complete raphe system located on the valve face alone and does not extend onto the valve mantle (II). Only two species are known thus far for the genus (one recent, one fossil); both small with rather indistinct striae which are difficult to resolve under LM. No spines are present. In girdle view cells have a pronounced wedge shape (Fig. 58: D). A single **rimoportula** (labiate or lipped process; Fig. 58: D) is present on either the head or the foot pole which can only be seen in SEM (Fig. 58: I).

Plastid structure – Plastid structure is unknown at this time.

Identification of species – Species and varieties in this genus are distinguished based on cell size and shape and importantly the shape of the apices.

Ecology – Cells probably solitary. Found in acidic oligotrophic waters.



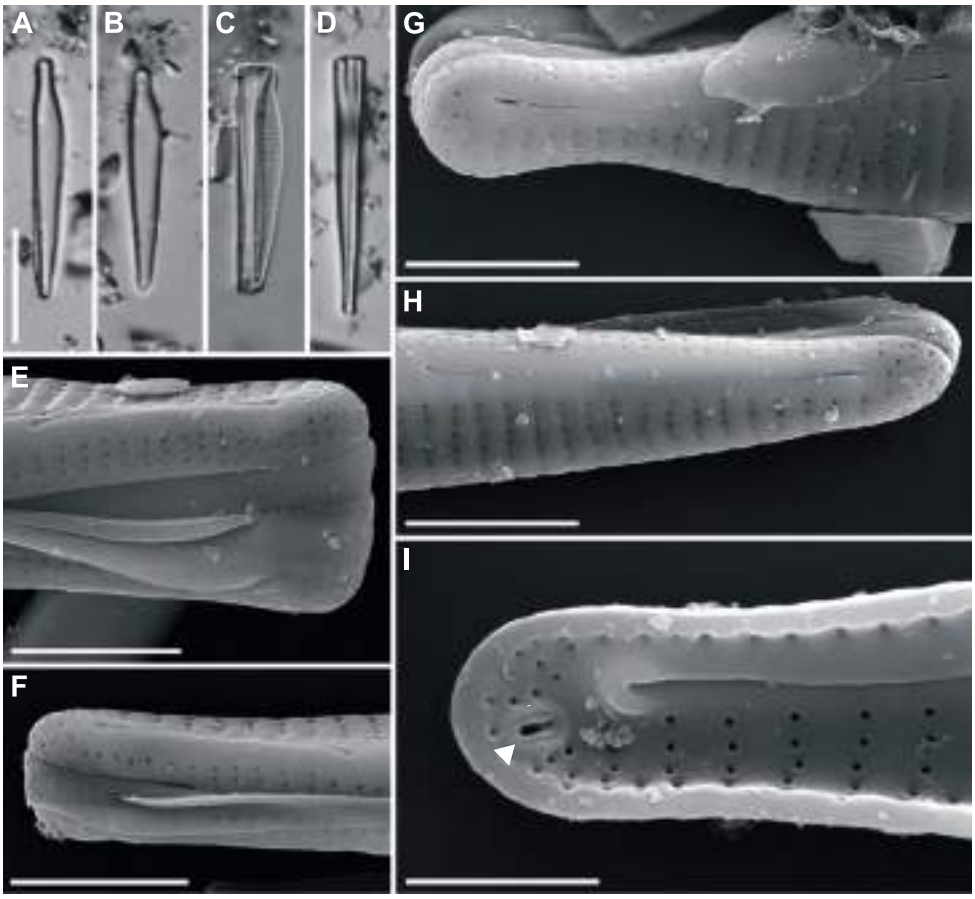


Fig. 58. *Actinellopsis murphyi*. **A-D**. LM. **A-B**. Valve view of cleaned material. **C**. Oblique view showing both valve face and girdle. **D**. Girdle view. **E-I**. SEM. **E.** Head pole, girdle view. **F**. Foot pole, girdle view. **E-F**. Showing the raphe does not extend onto the mantle. **G**. Head pole, external valve face. **H**. Foot pole, external valve face. **I**. Internal view of the head pole showing weakly developed rimoportula (arrow).
Scale bars = 10 µm (A-D), 2 µm (E-H), 1 µm (I).

Desmogonium Ehrenberg 1848

Type species: *Desmogonium guianense* Ehrenberg

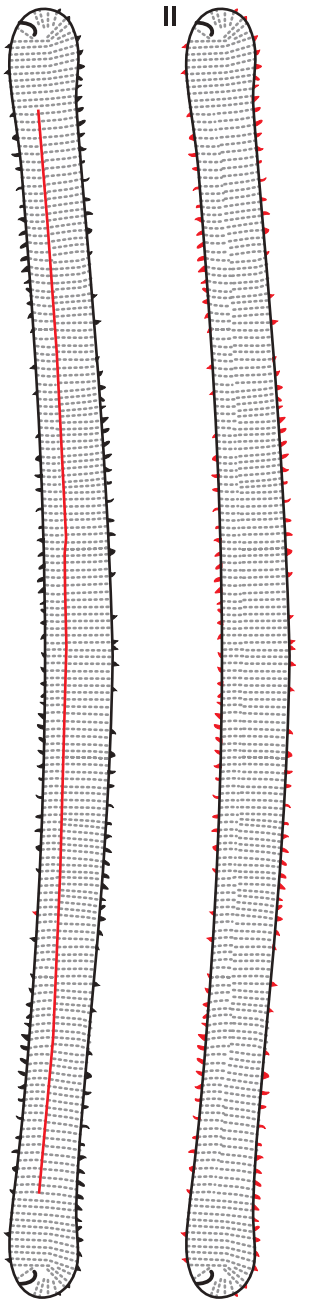
SYNONYM:
Eunotia Ehrenberg 1837 pro parte

Characteristics – Cells **raphid**, dorsiventral, slightly **lunate** and large. Striae coarse and easily discernable interrupted near the ventral valve margin forming a narrow longitudinal line running from apex to apex (I). Raphe branches on the valve face are very short and curved with the majority of the raphe structure found on the mantle (Fig. 60: G). Cells always have spines at the junction of the valve face and mantle; these may be more or less visible depending of focal depth (II, Fig. 60: A-H; Fig. 61: A, B).

Plastid structure – Cells with 2 elongate plastids lying on the ventral side of the cell and extending under the valve faces (similar to *Eunotia*) (Fig. 59: D).

Identification of species – Species can be identified by cell size, cell shape, shape of the apices and structure and density of the striae.

Ecology – Cells solitary and motile, or forming colonies and then cells connected at both poles. Found in the benthos of acidic oligotrophic waters with low conductivity.



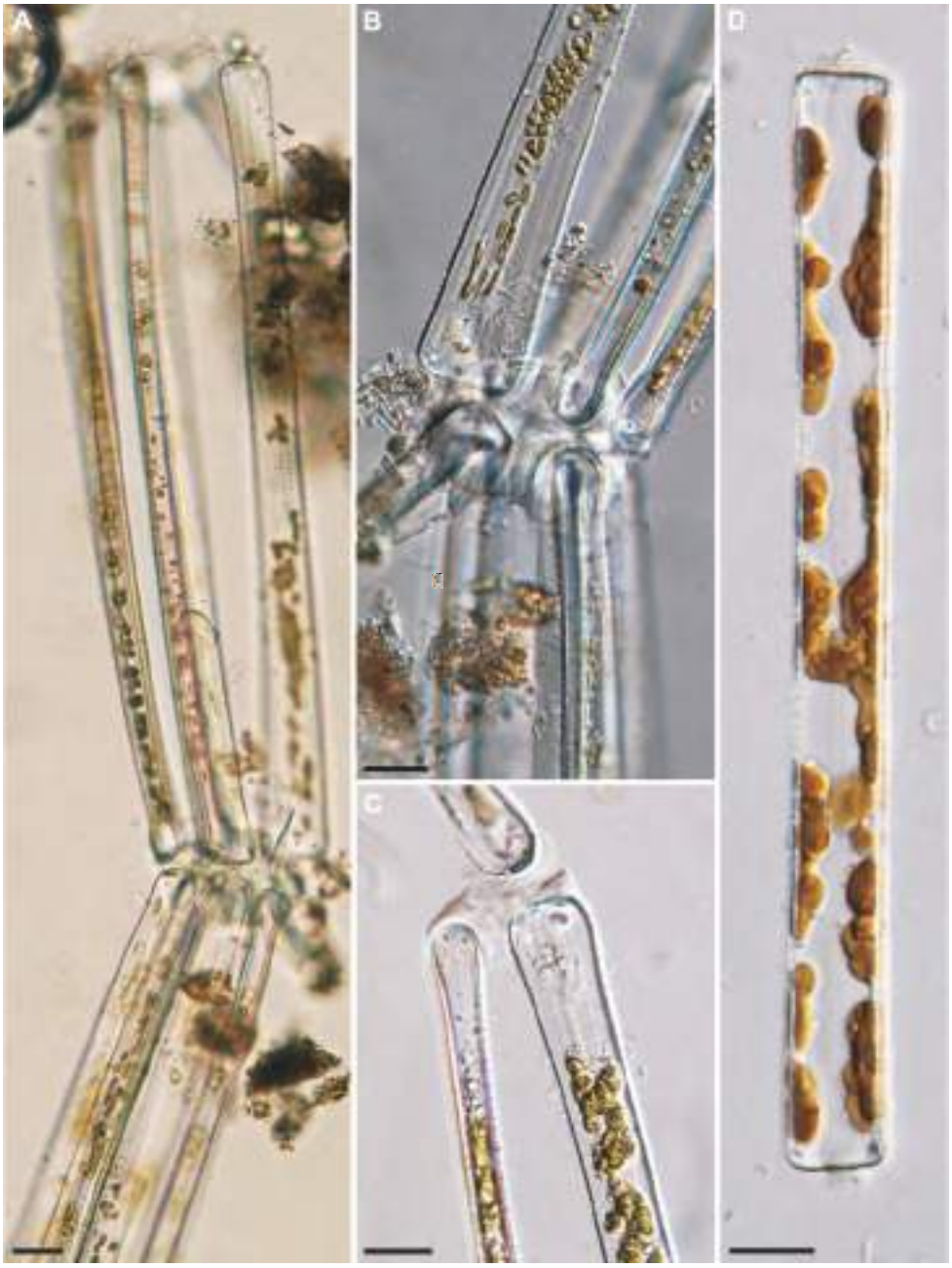


Fig. 59. *Desmogonium* spp. **A-D**. LM, living cells. **A-C**. Cells forming colonies, connected at both apices. **D**. Solitary cell, girdle view.
Scale bars = 10 µm.

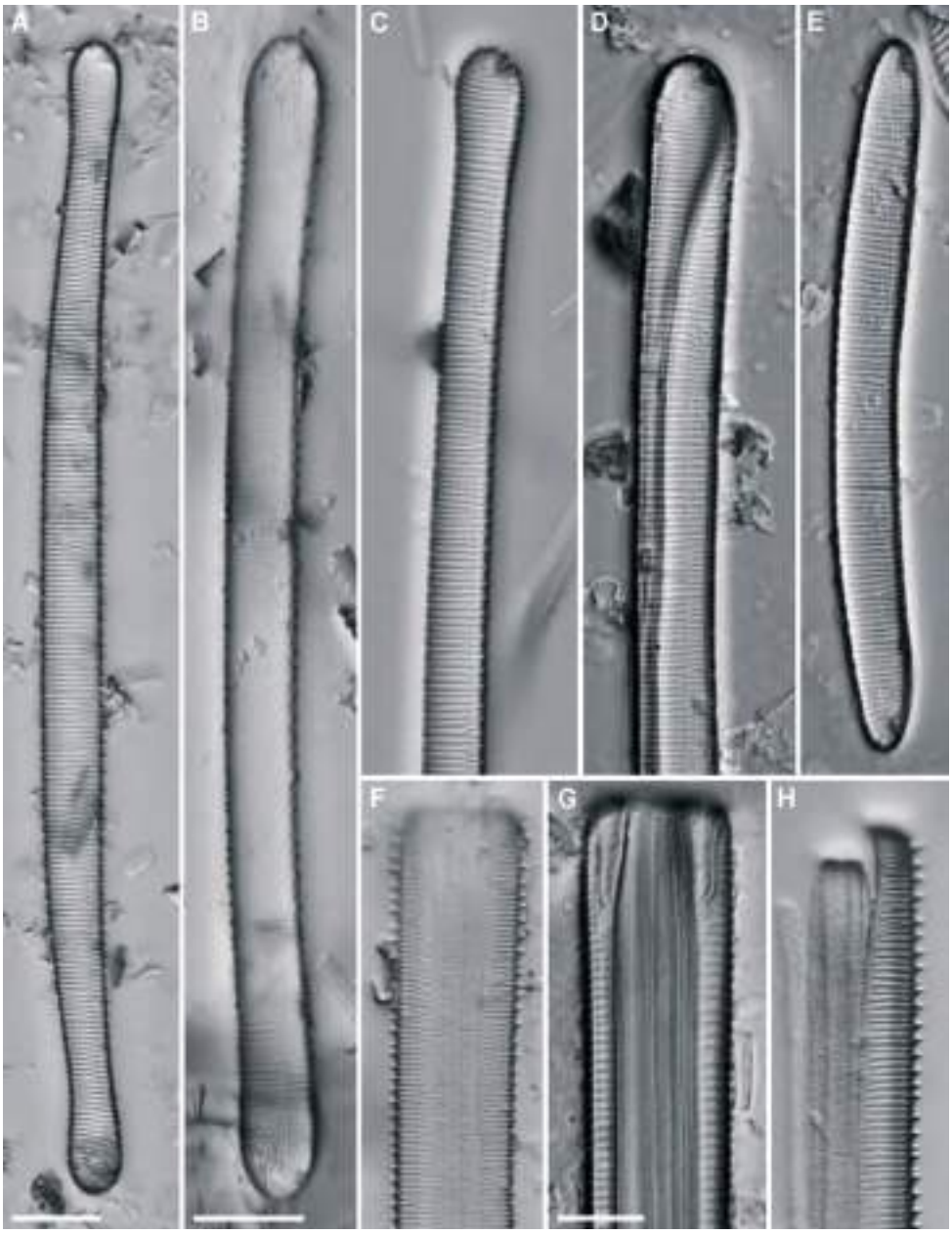


Fig. 60. *Desmogonium* spp. **A-H**. LM. **A-E**. Valve views of cleaned material. **F-H**. Girdle views of cleaned material, note marginal spines. Scale bars = 10 µm.

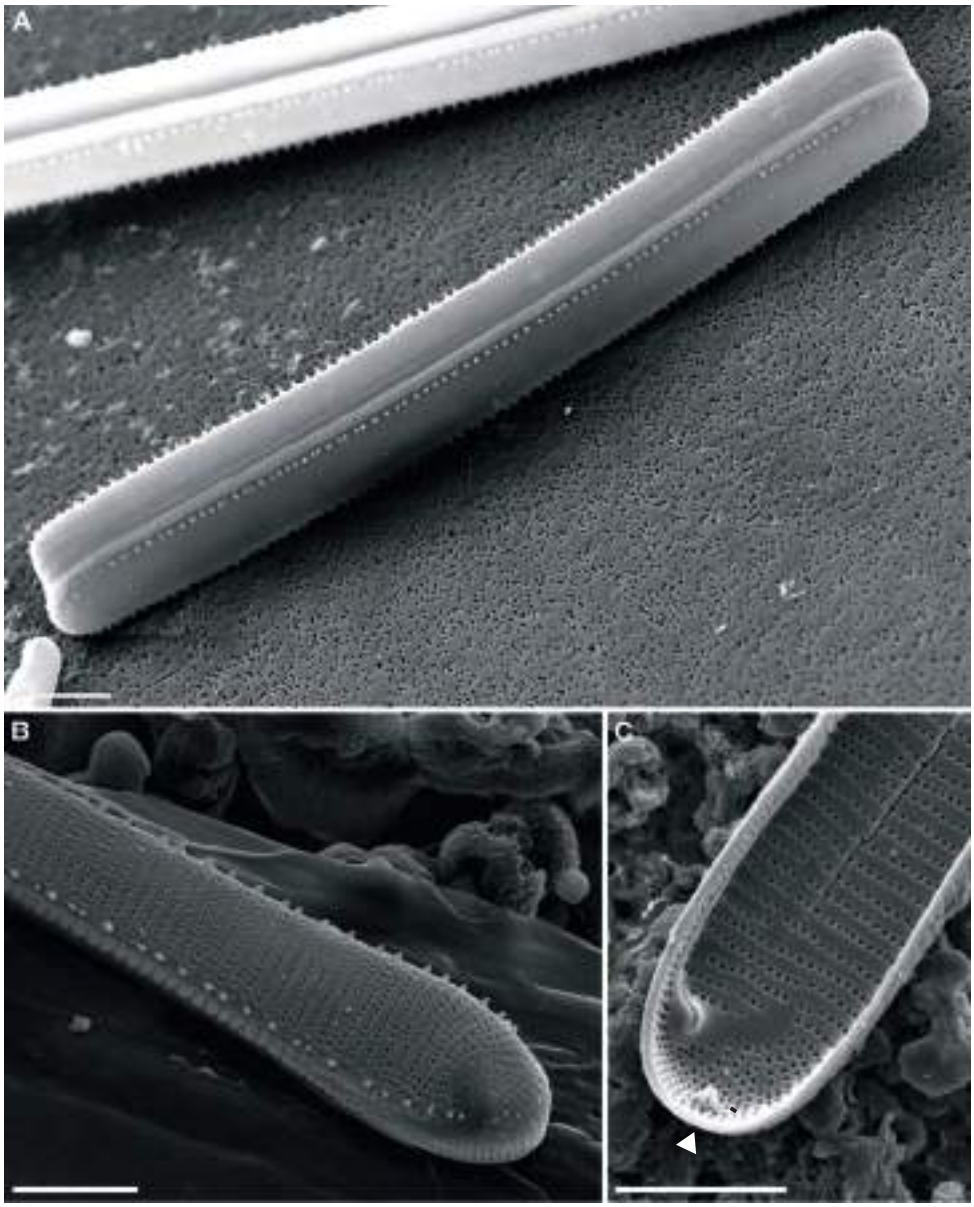


Fig. 61. *Desmogonium* spp. **A-C**. SEM. **A**. Oblique view of whole cell. **B**. External view of valve apex showing raphe ending and marginal spines. **C**. Internal view of valve showing raphe ending and rimoportula (arrow).
Scale bars = 10 µm (A), 5 µm (B-C).

Eunotia Ehrenberg 1837

Type species: *Eunotia arcus* Ehrenberg

Characteristics – Cells **raphid**, **dorsiventral**, **lunate** and highly variable in size. Raphe branches on the valve are very short and curved (I) with the majority of the raphe structure found on the valve mantle (II, Fig. 65: C). Cells rarely have spines at the junction of the valve face and valve mantle, apical spine may be present. Areolae often visible.

Plastid structure – Variable, some species with 2 elongate plastids lying on the ventral side of the cell and extending under the valve faces (Fig. 62: C), others with many granular plastids (Fig. 63: C) .

Identification of species – Species can be identified by cell size, cell shape, shape of the apices and structure and density of the striae and areolae, position of the raphe as well as the degree to which the cell is curved. Number of undulations on the dorsal margin are sometimes, but not always, a good character to distinguish species.

Ecology – Cells solitary and motile, also colonial and linked face to face to form ribbon-like colonies (Fig. 63: A-B) or linked corner to corner (Fig. 63: D) or grouped, joined at the base of the cells (Fig. 63: E). Found in the benthos of acidic oligotrophic waters with low conductivity, some species may be found in waters with higher trophic levels.

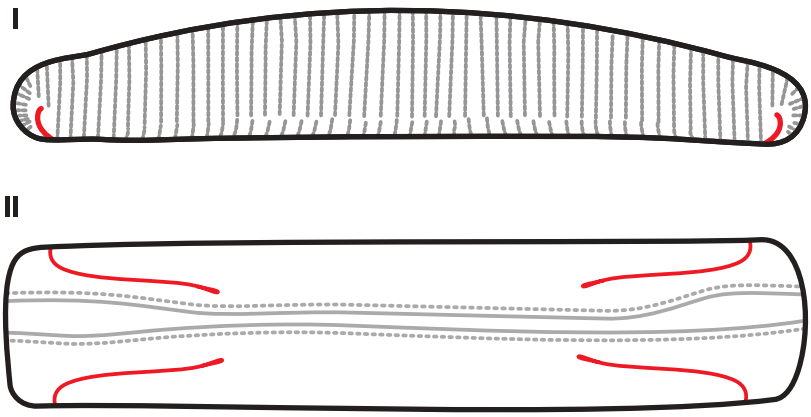


Fig. 62. *Eunotia spp*. **A-E**. LM, living cells. **A**. Valve view. **B-C**. *Eunotia exigua* (Brébisson ex Kützing) Rabenhorst, valve view (**B**), girdle view (**C**). **D-E**. Girdle views of *Eunotia* sp., note large lipid droplets (arrow).
Scale bars = 10 µm (A-E).

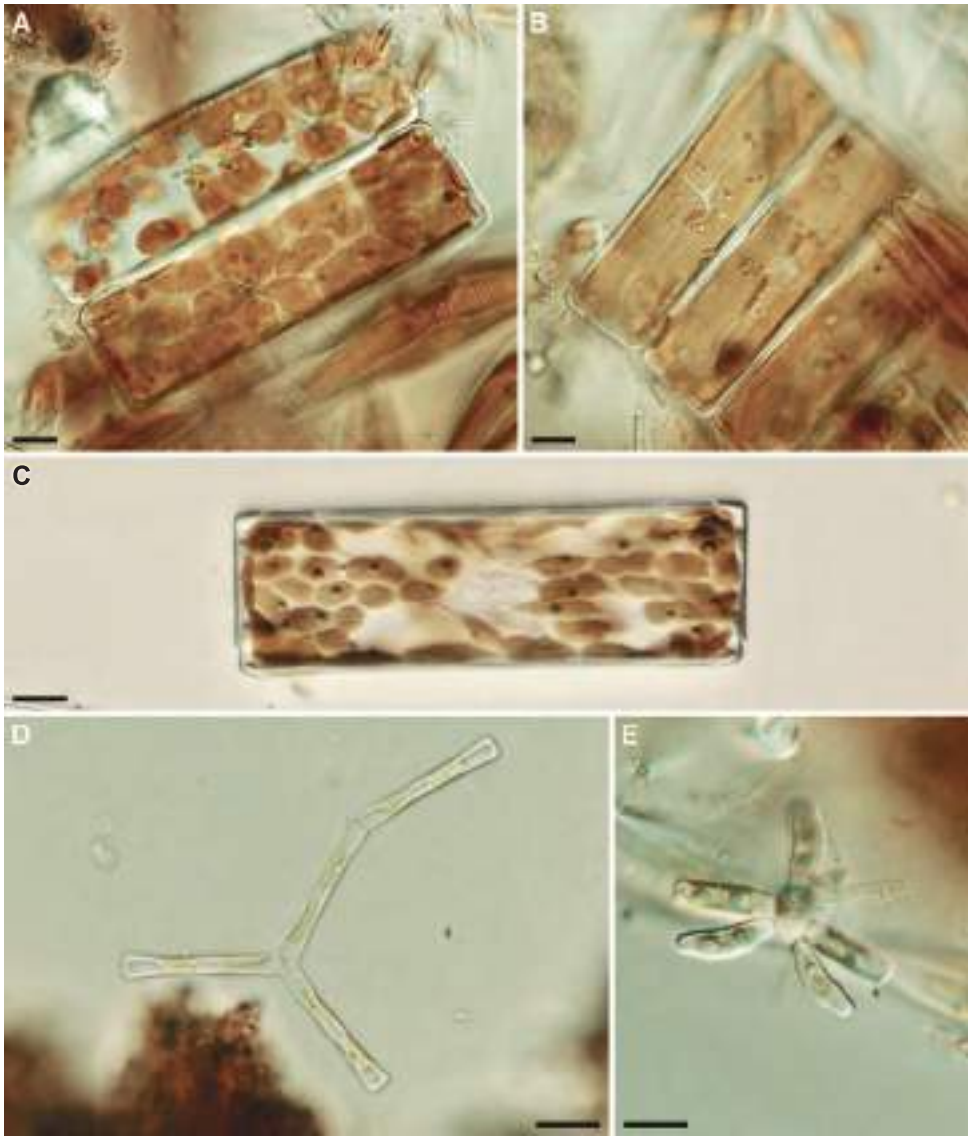


Fig. 63. *Eunotia* spp. **A-E**. LM, living cells. **A-B**. Large chain forming cells. **C**. Girdle view showing many small granular plastids. **D**. Cells linked at the corners to form colony. **E**. Cells united on a single mucilage pad and forming a colony. Scale bars = 10 µm (A-E).

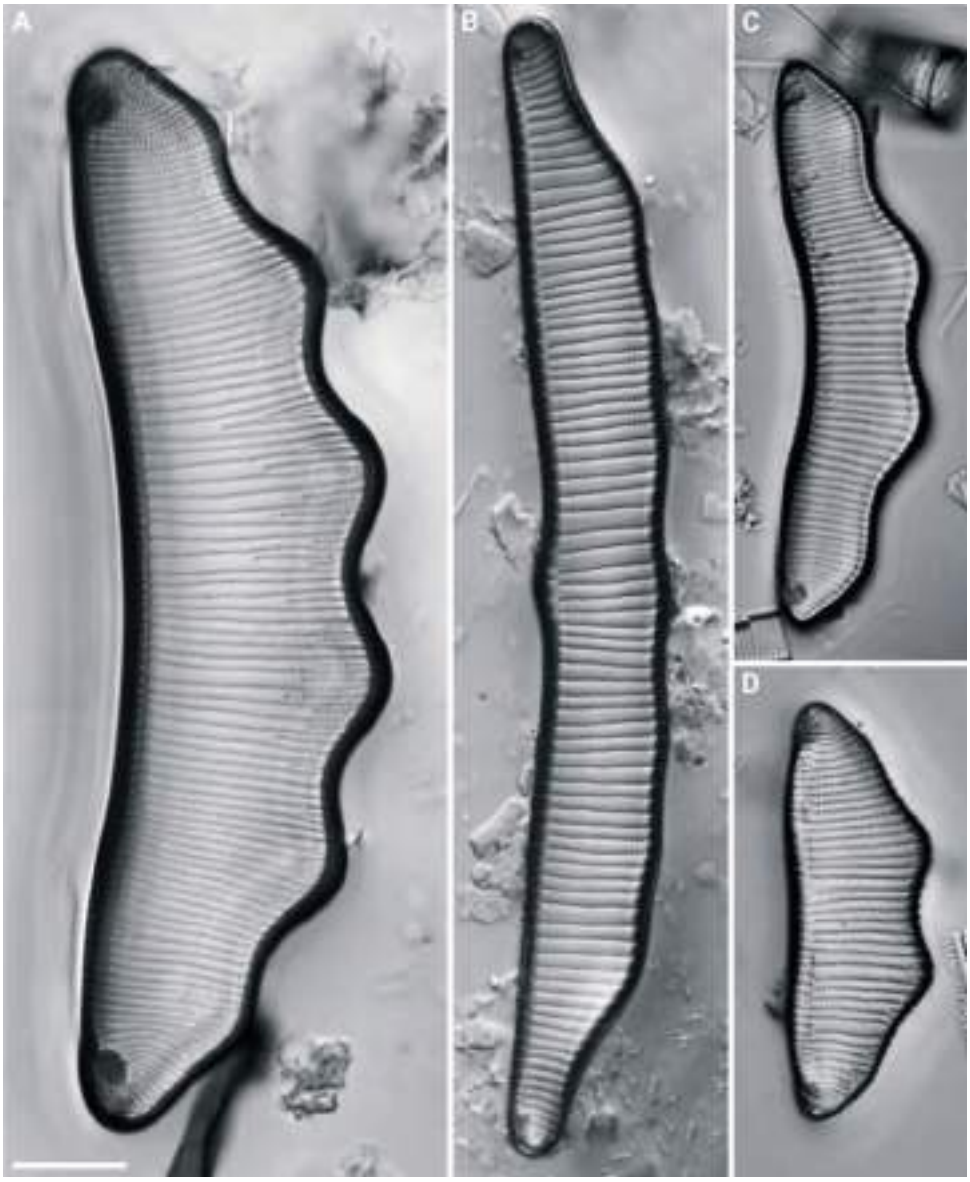


Fig. 64. *Eunotia* spp. **A-D**. LM, cleaned material of large-celled *Eunotia* spp. **B**. *Eunotia pectinalis* (Kützing) Rabenhorst. **C**. *E. zygodon* Ehrenberg. Scale bar = 10 µm.

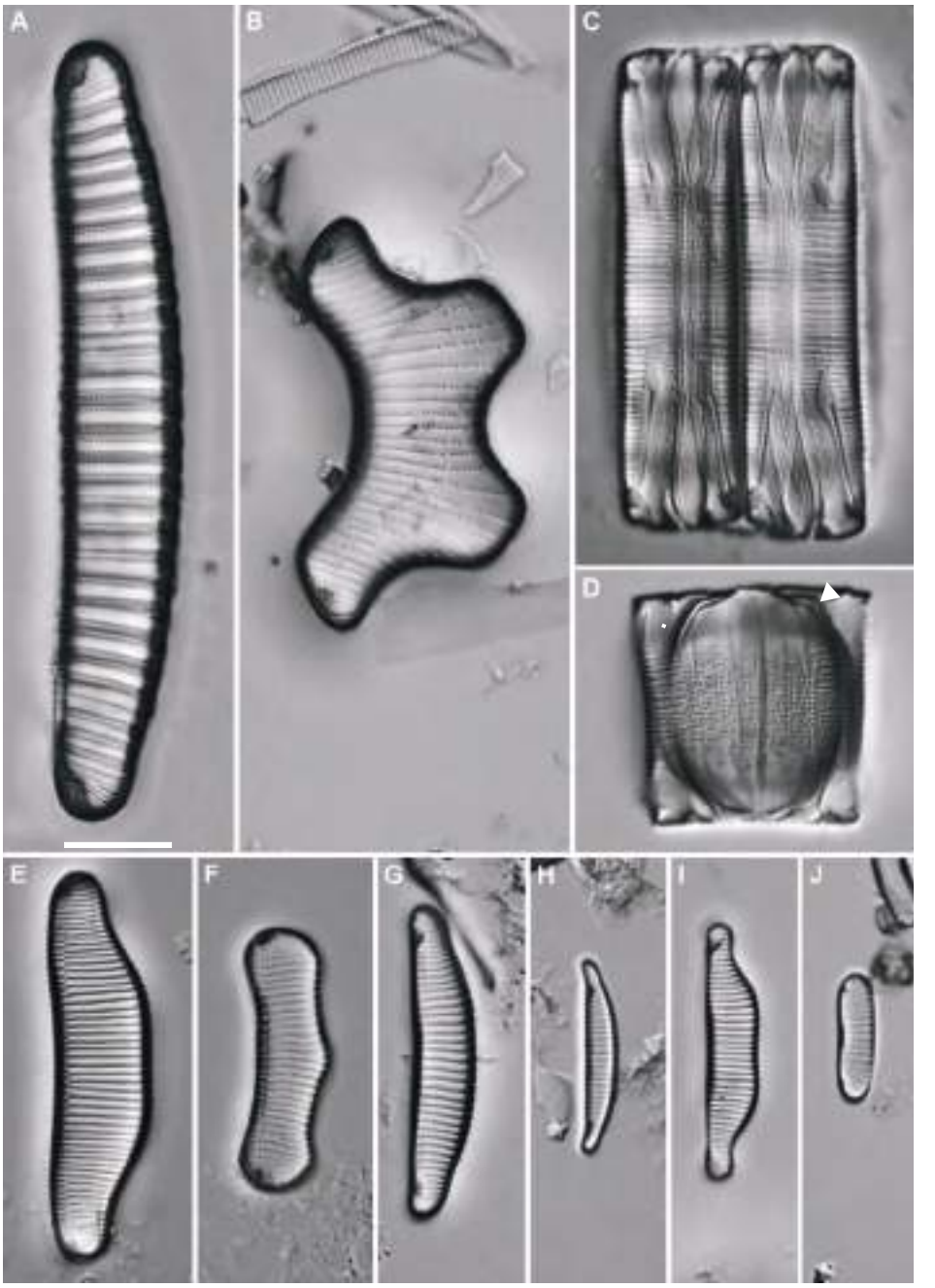


Fig. 65. *Eunotia* spp. **A-J**. LM, cleaned material. **A**. *Eunotia epithemioides* Hustedt. **C**. Ventral girdle view of two cells immediately post cell division. **D**. Girdle view, double thecae or internal septa (arrow), produced during resting spore formation. **F**. *E. rabenhorstii* Cleve & Grunow. Scale bar = 10 µm.

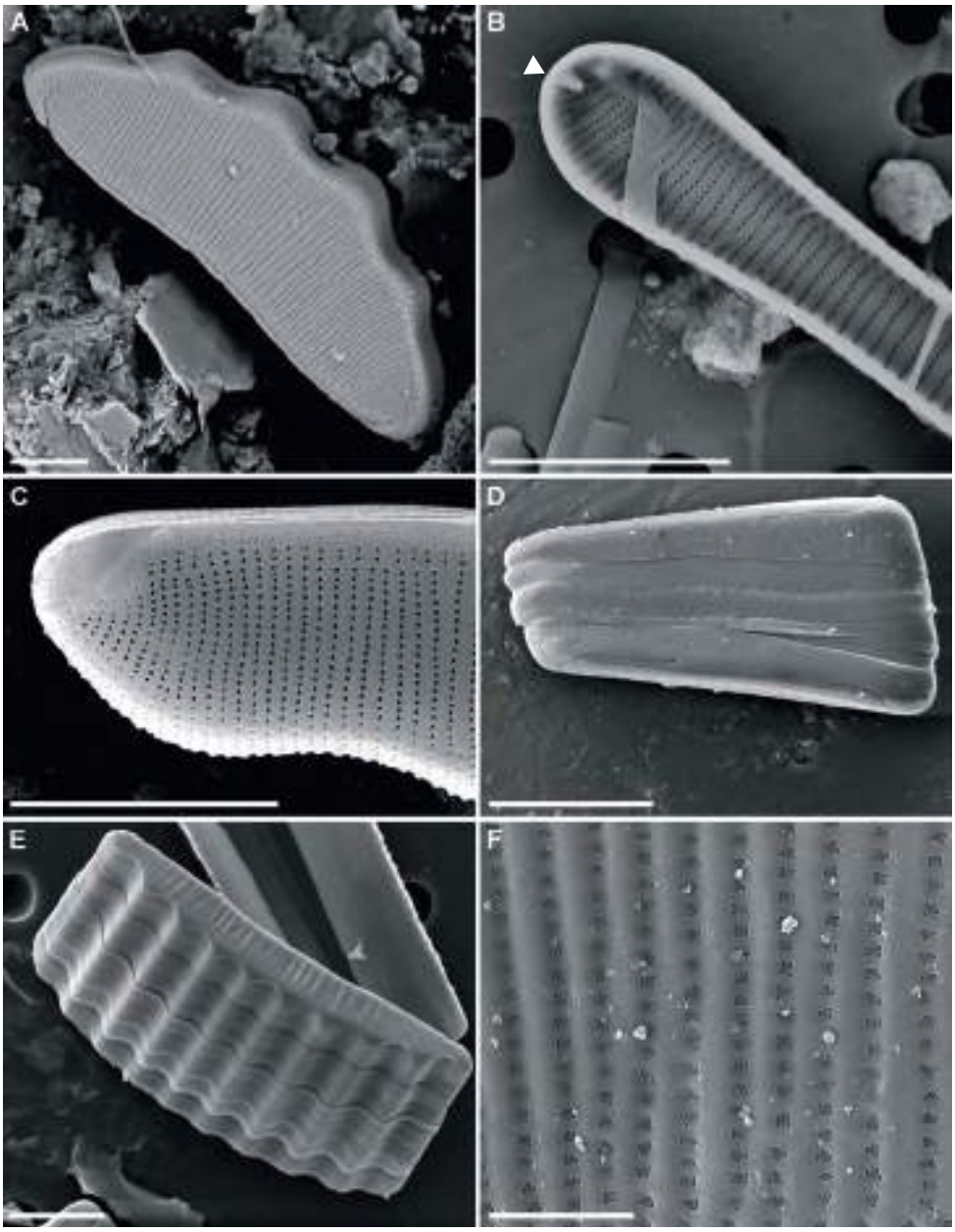


Fig. 66. *Eunotia* spp. **A-F**. SEM. **A**. External view of valve. **B**. Internal view of valve, note position of rimoportula (arrow). **C**. External view of apex of *E. zygodon*. **D**. Girdle view. **E**. Oblique view showing dorsal copulae. **F**. External view of areolae.
Scale bars = 10 µm (A-E), 2 µm (F).

Mastogloia (Thwaites) W. Smith 1856

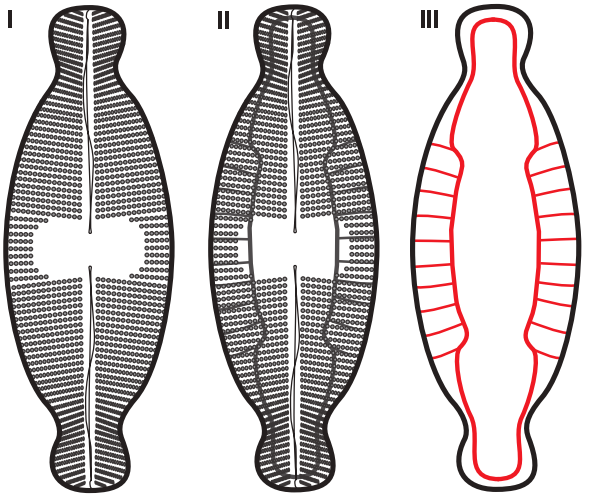
Type species: *Mastogloia dansei* (Thwaites) Thwaites ex W. Smith

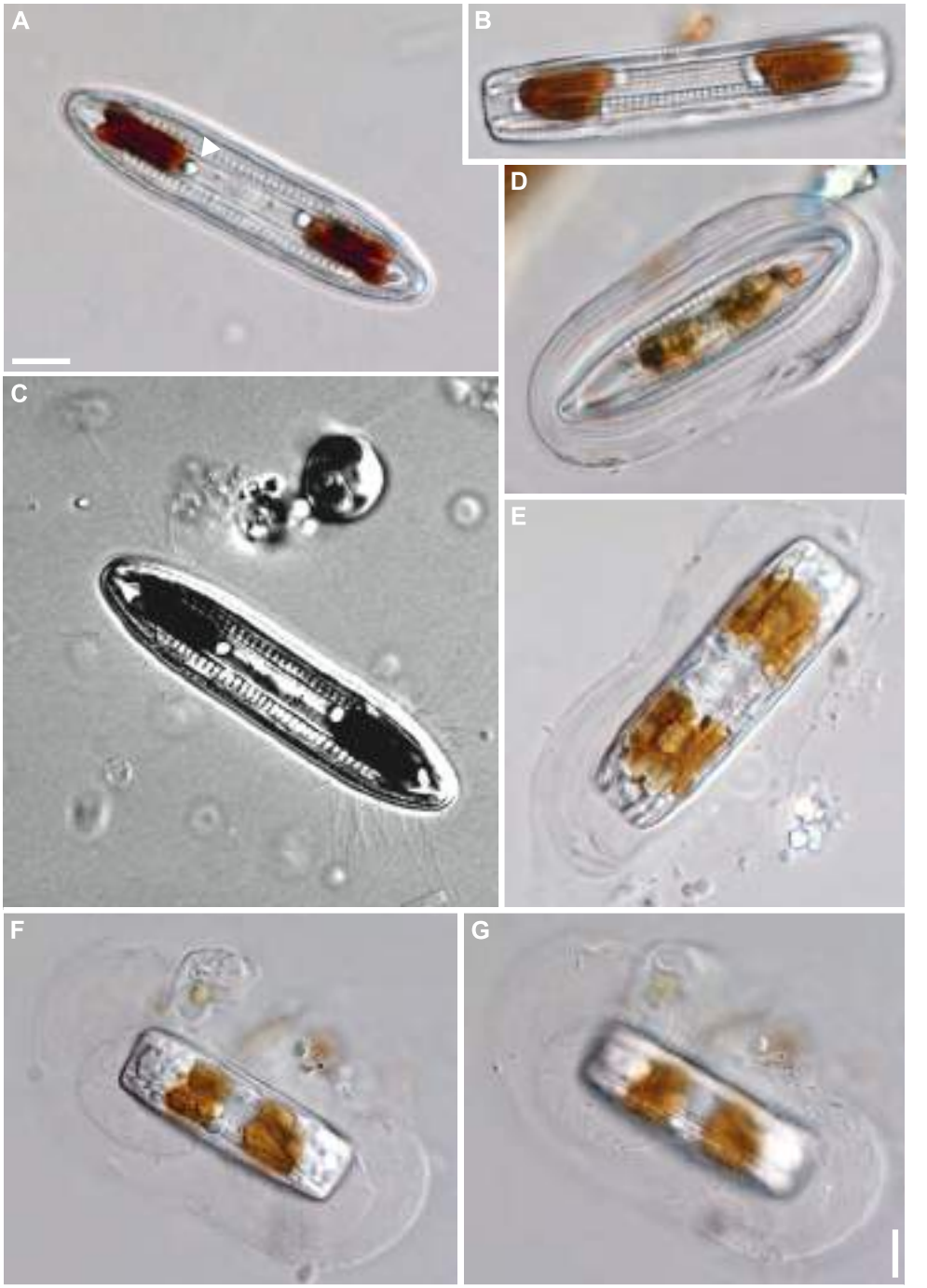
Characteristics – This genus is most noticeably distinguished in light microscopy by the **partecta** or chambers (III, Fig. 68: B, D-F) associated with the first girdle band or **valvocopula**. When seen from the girdle in SEM the large perforations extending into the **partecta** are clearly visible (Fig. 68: G). The raphe usually appears highly sinuous and complex. Areolae are large and clearly visible in LM. In living cells mucilage threads are exuded from the **parteca** (Fig. 67: C), this mucilage often encapsulates the entire cell (as illustrated in Fig. 67: D-G) and may play some role in allowing these cells to survive dessication and other unfavorable circumstances such as shifts in osmotic pressure.

Plastid structure – There are two small double lobed plastids found at each end of the cell (Fig. 67: A, B) with a pyrenoid between the two lobes of each plastid (Fig. 67: E). Usually two lipid droplets are present (Fig. 67: A).

Identification of species – Species in this genus are distinguished based on cell size and shape as well as the shape of the apices. Striae density and orientation are also of importance as well as the size of the areolae.

Ecology – Cells solitary, motile or encased in mucilage. The majority of species are brackish or marine but some are also found in fresh waters of higher electrolyte content and calcium rich waters.




A
B
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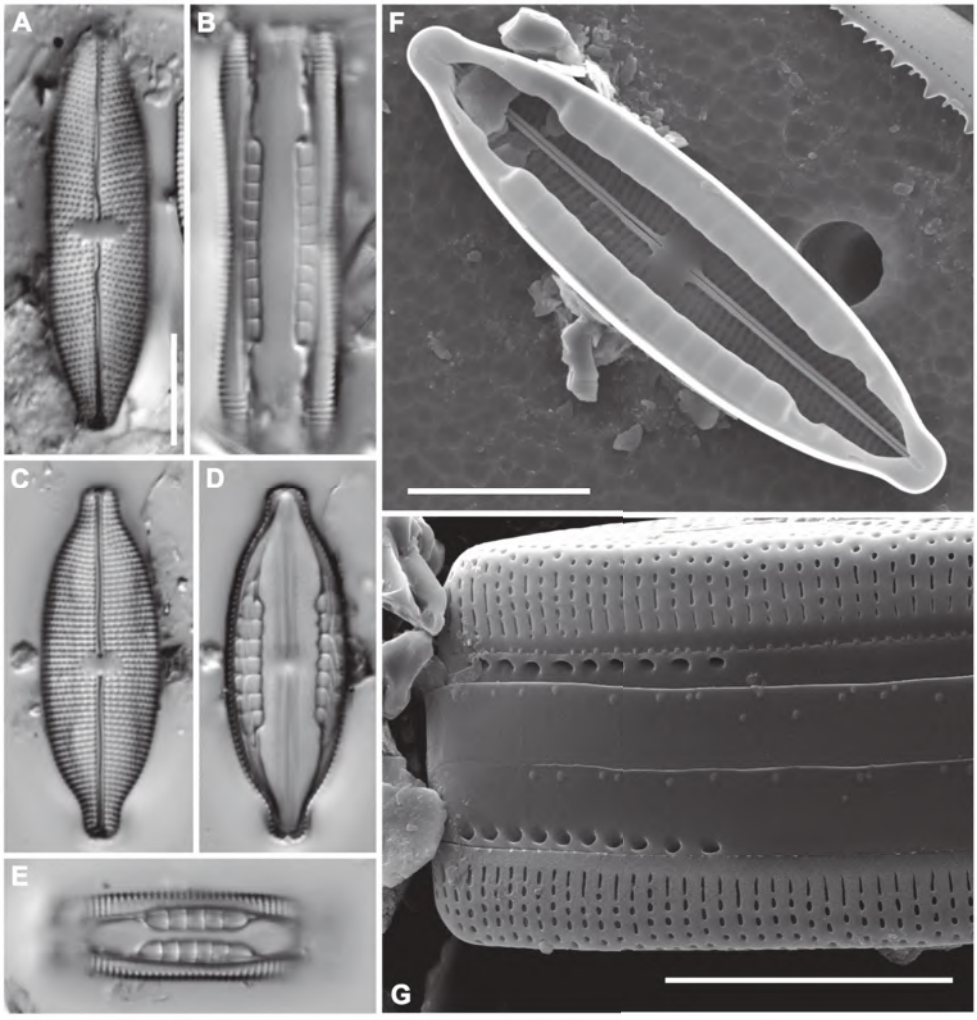

Fig. 68. *Mastogloia* spp. **A-E**. LM of cleaned material. **A, C.** Valve view. **B, E.** Girdle view. **D**. Detail of the valvocopula. **F-G**. SEM. **F**. Internal view of valvocopula showing the partecta. **G**. Girdle view, note external openings of the partecta through which the mucilage is exuded.
Scale bars = 10 µm (A-F), 3 µm (G).

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Fig. 67. *Mastogloia* spp. **A-G**. LM, living cells. **A**. Valve view, note the lipid droplets associated with each plastid (arrow). **B**. Girdle view. **C**. Living cell (high contrast), mucilage threads protruding from the partecta. **D-G**. Living cells encapsulated in mucilage, note threads protruding from partecta.
Scale bars = 10 µm (A-G).

Rhoicosphenia Grunow 1860

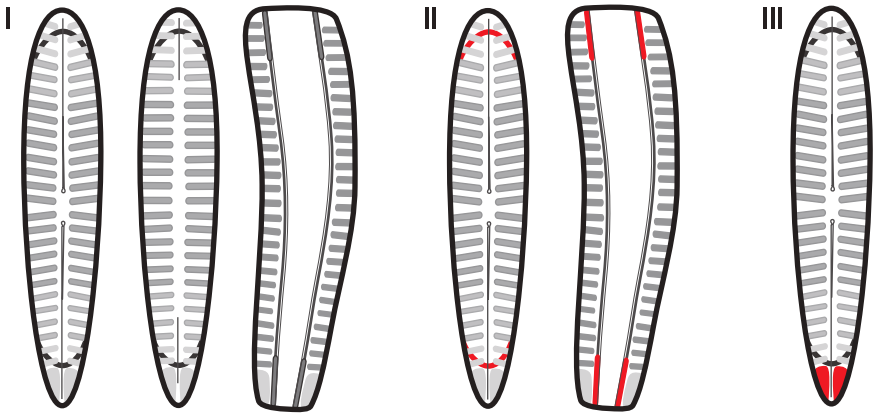
Type species: *Rhoicosphenia curvata* (Kützing) Grunow

Characteristics – Cells **biraphid**, **heterovalvar**, **heteropolar** and curved in girdle view (one valve convex the other concave). Broadly rounded head pole and narrowly rounded foot pole. Striae robust, composed of single rows of elongate areolae. **Pseudosepta** (II, Fig. 69: I) are present at both poles, **apical pore field** (III) present at the base pole. Convex valve bears a full length raphe (Fig. 69: A, F) while the concave valve bears shortened or rudimentary raphe branches near the apices (Fig. 69: B, E).

Plastid structure – Single H-shaped lobed plastid with central narrow pyrenoid.

Identification of species – Up till now only one species known from tropical Africa: *Rhoicosphenia abbreviata* (C. Agardh) Lange-Bertalot (a homonym of *Rhoicosphenia curvata*).

Ecology – Cells solitary or in pairs, attached to substrate by short mucilage stalks, may be re-suspended in the plankton. Found in the benthos of eutrophic waters with moderate conductivities.



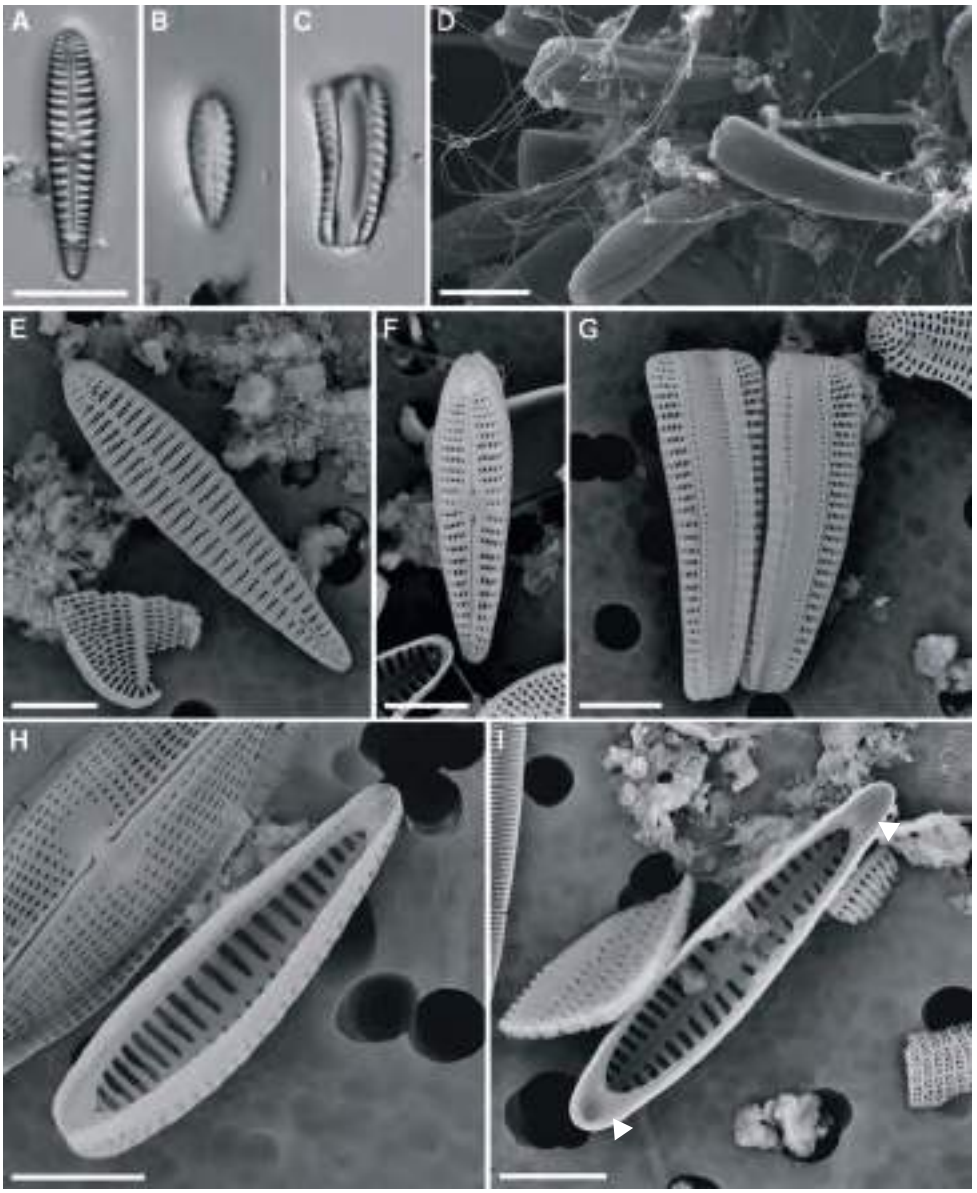


Fig. 69. *Rhoicosphenia abbreviata*. **A-C**. LM. **A-B.** Valve view. **C.** Girdle view. **D-I.** SEM. **D.** Cells of biofilm. **E**. External view of concave valve, note shortened rudimentary raphe. **F.** External view of convexe valve. **G.** Girdle view. **H.** Internal view of concave valve with shortened raphe. **I.** Internal view of convexe valve, note pseudosepta (arrows).
Scale bars = 10 µm (A-D), 5 µm (E-I).

Anomoeoneis Pfitzer 1871

Type species: *Anomoeoneis sphaerophora* Pfitzer

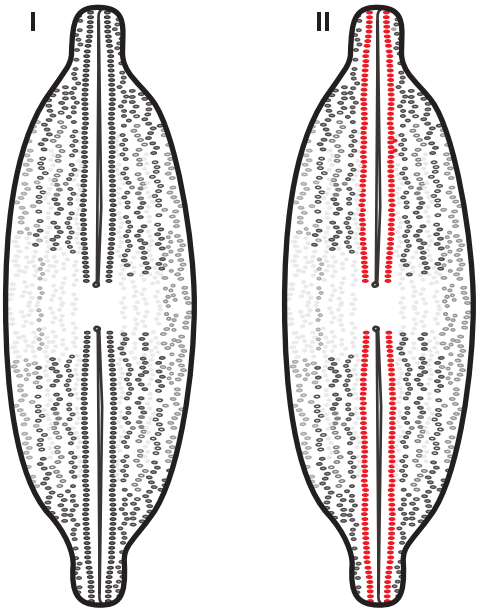
SYNONYM:
Brachysira Kützing 1836 pro parte

Characteristics – This genus is most noticeably distinguished in light microscopy by the scattered areolae on the valve face forming uneven **transapical lines** (I; Fig. 70: D-F). A number of '**ghost areolae**' (pictured as light grey dots - I, II) are found on the valve face and are especially visible in the **central area (**Fig. 70: H), these areolae do not perforate the **valve face**.

Plastid structure – The single plastid is large and occupies most of the cell (Fig. 70: A, B), it has two lobes, one appressed to each valve face forming a H-shape when seen from the girdle (Fig. 70: C). One large pyrenoid is found adjacent to the cell margin. The plastid arrangement is similar to that of *Cymbella* and *Gomphonema*, hence its placement in the order Cymbellales.

Identification of species – Species and varieties in this genus are distinguished based on cell size and shape as well as the shape of the apices.

Ecology – Cells solitary, motile. Commonly found in waters of higher electrolyte content.



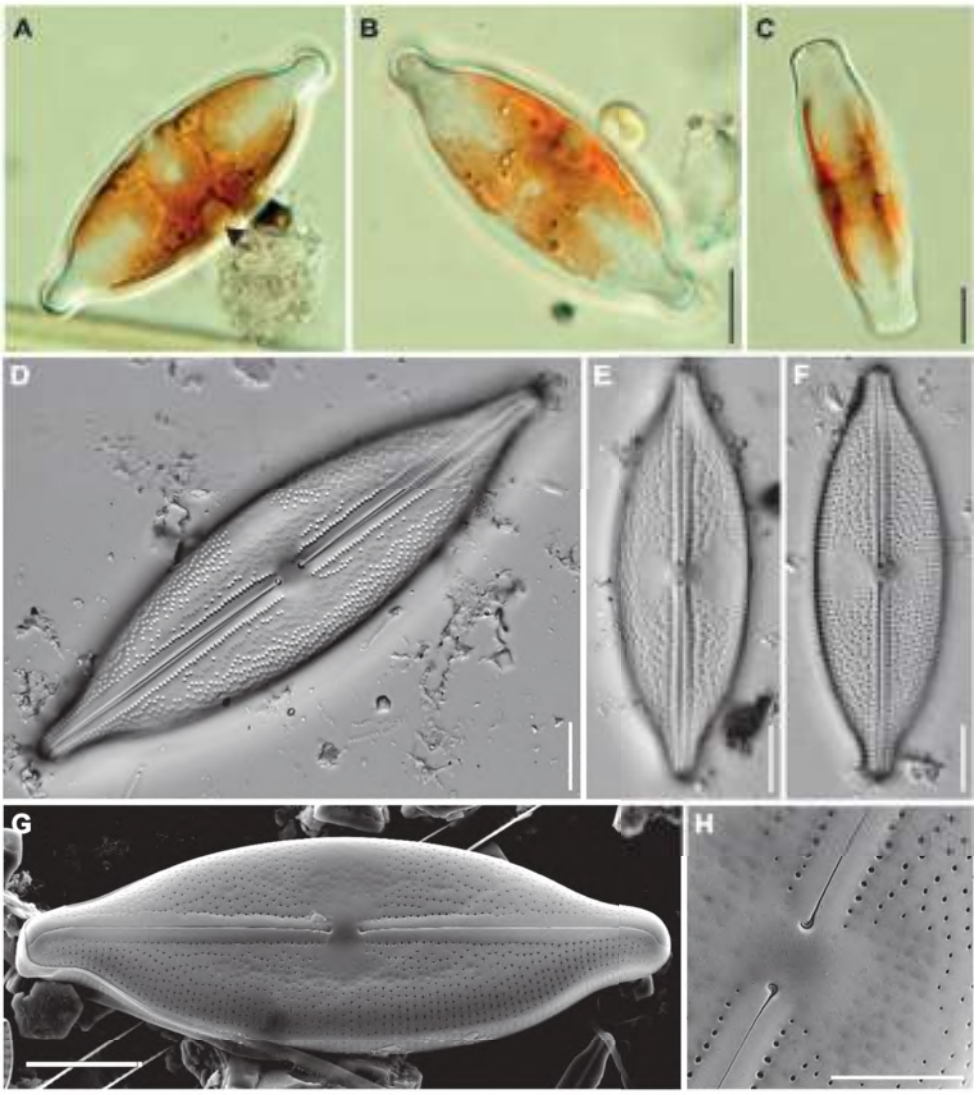


Fig. 70. *Anomoeoneis sphaerophora*. **A-F**. LM. **A**. Living cell, note pyrenoid (arrow) next to the cell margin. **B**. Living cell, note H-shaped plastid. **C**. Living cell, girdle view, note bridge between the two plates of the plastid. **D-F**. Cleaned valves, note the feint ghost areolae in the central area. **G-H.** SEM. **G.** Valve view of complete valve. **H**. Detail of central raphe endings.
Scale bars = 10 µm (A-G), 5 µm (H).